

THE RELATIONSHIP BETWEEN LEARNING STYLE
PREFERENCES OF PHYSICAL THERAPIST
ASSISTANT STUDENTS AND SELECTED
DEMOGRAPHICS: IMPLICATIONS
FOR TEACHING

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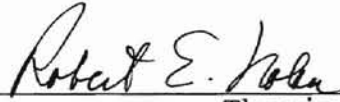
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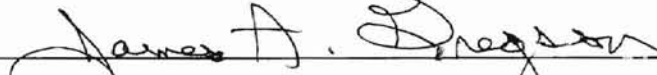
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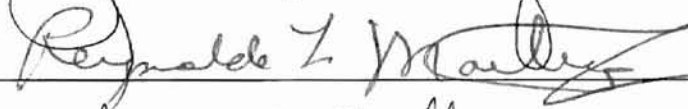
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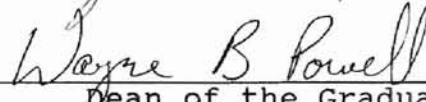
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I dedicate this thesis to the memory of my father, Roy

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CHAPTER I

INTRODUCTION

Educators have long recognized that people learn in different ways. Some individuals learn by doing, others by watching, some by thinking and reflecting on experience while others use more intuitive methods (Kolb, 1984). Learning style influences such things as the setting in which people like to learn, the kinds of things they want to learn, and how they will approach the learning situation (Conti & Welborn, 1986). No two students learn exactly the same way.

Most educators agree that the "traditional" college student we knew twenty, or even ten, years ago may rapidly be losing majority status. Older students with wide ranges of previous educational and work experience are becoming more and more common in post-secondary education. In addition, many experienced instructors would also agree with David Kolb and his colleagues (Kolb, 1976) that approaches to learning are affected to some degree by age, life, and work.

Therefore, faced with a literal knowledge explosion in the later half of this century, college instructors find that not only are efficient teaching techniques necessary to cope with the volume of information, but that multi-modal forms of instruction may be needed given the diversity of the student population. In striving to prepare students for careers and for life-long learning, exploration of the teaching and learning process of "non-traditional" students as well as "traditional" students becomes a priority for conscientious

educators.

Statement of the Problem

Differences among student learning styles and individual preferences for dealing with information have been of interest to nursing and medical educators for many years. If there are differences in the ways in which individuals process information and learn, then this is of obvious importance to all educators (Cawley, Miller & Milligan, 1976). The question that this study seeks to answer is, given that there are differences in how students process information and approach learning, is there a predominant learning style among students enrolled in a specific course of study? And, does it appear that the age and gender of these students affect their learning style? In order to maximize the quality and efficiency of PTA curriculums, it would be helpful to physical therapist assistant educators to know if students share a predominant learning style and how that learning style is affected by age and gender.

A secondary problem is to determine how teaching methods and materials might be manipulated to match differences in learning styles. It has been a personal observation of the author that some students experience stress in moving from the classroom to the clinical environment and may have some difficulty in the practical application of theoretical principles learned in the classroom. Is it possible that this difficulty is due, at

least in part, to the fact that learning in the clinic demands a different style than learning in the classroom? Can we alter the teaching environment in such a way as to make it easier for students to make the shift from the classroom to the clinic?

With an eye toward improving instructional strategies, a few attempts have been made in recent years to determine if students enrolled in allied health curriculums shared a preference for a particular learning style. Very little study has been done with regard to learning style with students enrolled in physical therapy programs and no research has been done to date using physical therapy assistant students as subjects. Additionally, there is no evidence to either verify or negate the difficulties students seem to experience in moving from classroom to clinical learning environments. This study was needed to gain insight into the learning styles of physical therapy assistant students in order to enhance the teaching and learning processes in physical therapist assistant curriculums.

Interest in learning style and the need to measure it has prompted many investigations of student populations. Kolb's LSI has been frequently used to study students in allied health, nursing and medical education programs. While few people argue with the actual model of experiential learning as proposed by Kolb, issues of reliability and validity have plagued studies employing the inventory with

many of the difficulties centering around small sample sizes and the lack of norms for comparison. Since the instrument continues to be widely disseminated as a tool in educational and management settings, it has been suggested that further research in this area would be of some value in clarifying the controversy surrounding the use of the LSI as a predictive or career counseling tool.

Purpose of the Study

The purpose of this study was to determine if first year physical therapist assistant (PTA) students have a predominant learning style and to determine the relationships between student learning styles, age and gender.

Objectives of the Study

The objectives of the study were:

- 1) To determine the predominant learning style of first year physical therapy assistant students.
- 2) To determine if there is a relationship between student learning style and age.
- 3) To determine if there is a relationship between student learning style and gender.

A secondary purpose of the study is to explore ways in which learning style can be related to teaching methods and learning environments.

Assumptions

In preparing this study and interpreting the results, the following assumptions were accepted by the investigator:

1. That students participating in this study correctly followed instructions when completing the inventory and performed the simple computations accurately. Random spot checking of student responses by the investigator indicated that students followed instructions and performed sample computations accurately.

2. That student responses on the inventory are honest and carefully considered. Students routinely expressed a keen interest in learning more about their own learning styles and orientations. Since students view this information as helpful to them in their academic and clinical work, they were motivated to take the inventory seriously and completed the statements in a thoughtful manner.

3. That students participating in this study are representative of future students enrolled in this program. The selection criteria students admitted to the Physical Therapist Assistant Program at Tulsa Community College has been the same since 1988 and will most likely remain the same for the foreseeable future. All the participants of this study were admitted to the program using identical selection criteria.

Scope of the Study

The scope of this study included students enrolled in the second semester of the five semester Physical Therapist Assistant Program at Tulsa Community College in Tulsa, Oklahoma from the years 1991 to 1995.

Limitations of the Study

The following limitations are recognized as factors which may have affected the results of this study and which may have implications for interpretation and application of the data.

1. This study shares the limitation of all studies based on self-report instruments. Validity of the resulting data of this study is predicated upon the assumption that student responses reflect the true feelings and opinions of the participants.

2. This inventory was administered in the beginning of the second semester of a five semester program. It is conceivable that educational experiences encountered in the first semester may have played some role in shaping student learning style.

3. Selection criteria for the Physical Therapist Assistant Program at Tulsa Community College is competitive. Although virtually all physical therapist assistant programs have some type of selection criteria, the criteria may differ significantly from school to school. It follows then, that there will be some limitation in applying the findings of this study to the entire population of physical therapist assistant students educated in this country.

4. Student preferences for concrete versus abstract and active versus reflective learning orientations are defined by David A. Kolb (1985) and measured by the LSI 1985.

Definition of Terms

The following are definitions furnished to provide clear meaning of terms used in this study.

1. Learning styles are: "consistent orientations toward learning and studying" (Messick, 1993, p. 2).

2. Learning orientations are: the modalities that students use to perceive and acquire information. According to Kolb (1984) the four learning orientations are concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). The relative reliance on one or more of these modalities defines individual learning style.

3. Cognitive styles are:
characteristic modes of perceiving, remembering, thinking, problem solving, and decision making, reflective of information-processing regularities that develop in congenital ways around underlying personality trends. They are inferred from consistent individual differences in ways of organizing and processing information and experience. (Messick, 1993, p. 3)

4. Learning or instructional preference is: "the individual's choice of environment in which to learn (p. 3)" (Curry, 1983, p. 3). An example would be a preference for attending a lecture versus a small group discussion.

5. Information processing style is: "the individual's intellectual approach to assimilating information following the classic model (sensory loading,

short-term memory, enhanced associations, coding system, long-term storage)" (Curry, 1983, p. 3).

6. The LSI 1985 is: a twelve item self-report inventory derived from constructs defined in David Kolb's experiential learning theory. The LSI 1985 measures student reliance on the four learning orientations of active experimentation, concrete experience, reflective observation and abstract conceptualization which combine to define an individual learning style.

7. Allied health is: a term generally applied to those occupations whose "primary function is to provide health care services or promote health" (p. 1). Preparation for allied health professions ranges from on-the-job training to postgraduate work. Examples of allied health careers are physical, occupational and respiratory therapy, dental hygiene, medical laboratory technology, radiography and medical assistants. Physical therapist assistants and occupational therapy assistants are considered allied health occupations (National Commission on Allied Health Education, 1980).

8. A physical therapist (PT) is: one who "plans, organizes and administers treatment in order to restore functional mobility, relieve pain, and prevent or limit permanent disability for those suffering from a disabling disease" (Savage, 1990, p. 677).

9. A physical therapist assistant (PTA) is: one who "administers physical therapy treatments to patients working

under the direction of and as an assistant to a physical therapist" (US Department of Labor, p. 63).

Structure of the Study

The study begins with a comprehensive review of the literature involving learning style models and the assessment of the various aspects of learning style in allied health students and related populations. Sections on the methodology employed in the study and the research findings as they relate to the objectives of the study follow. The study concludes with a summary of the conclusions drawn from the results of the study, a discussion of how learning style information might be practically utilized in the classroom and curriculum planning and identification of topics for further research.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Learning styles and individual approaches to learning have been a source of inquiry in medical education since the 1970's. Some have focused on the different ways in which students receive and process information and some under which conditions students prefer to learn. Others have investigated the relationships between student learning style and other variables such as age, gender and educational background.

Adult Cognitive Style

Learning styles and cognitive styles are not fixed traits, but do tend to be stable, consistent patterns of human behavior with regard to the individual's response to the environment (Witkin, Moore, Oltman, et al, 1977). Kirby (1979) defines cognitive style as the characteristic way that people perceive, organize and process information to make it meaningful for them. Cognitive style includes thinking and memory behavior used internally and is often used to describe human behavior in a variety of situations besides the teaching and learning one. According to Merritt (1983), cognitive personality style is the underlying and relatively stable dimension of an individual's personality that does not interact directly with the environment but does have wide applicability in predicting behavior. That behavior need not be confined to the learning environment.

In recent years, the concept of hemisphericity (the tendency to rely on one side of the brain more than the other) has been linked to cognitive style. It has been postulated that hemisphericity affects an individual's approach to learning and problem solving. Left hemisphere dominant people tend to use analytical, logical and sequential intellectual processes to solve problems. Right hemisphere dominant people are more non-verbal and visually-spatially oriented. These people tend to solve problems in a rather intuitive manner, attacking all sides of a problem simultaneously and using a more global, rather than sequential, approach. In this way adult cognitive style has an effect on learning style in adults (Springer and Deutsch, 1981). Instruments which have been developed to measure adult cognitive style may also yield information about the way the individuals process information in the learning environment.

The instrument most often used to measure adult cognitive personality style is the Myers-Briggs Type Indicator (MBTI). The MBTI is a measure of personality type which asks respondents to make choices on four scales: extroversion-introversion; sensing-intuitive; thinking-feeling; and judging-perceiving. The scales on the MBTI can be interpreted in terms of preferred learning environments. Those scaling high on the extrovert scale tend to like trial and error type learning situations, while those respondents who identify themselves as introverts prefer to reflect at

length before acting. Individuals scoring high on the sensing scale like to learn from experience and characterize themselves as practical, observant and good at remembering and working with facts. Those with intuitive personality types are imaginative, and are good at new ideas and problem solving. Respondents who report themselves as logical, analytical thinkers who like to weigh the facts tend to have high scores on the thinking scale, while those who like to consider personal values in decision making and are sympathetic score high on the feeling scale. Those who like to live in a planned, orderly way and prefer a controlled, predictable learning environment score high on the judging scale. Those persons who like to live in a flexible, spontaneous way attempting to adapt to different situations score high on the perception scale (Merritt, 1983; Claxton & Ralston, 1978).

Rezler and French (1975) studied 139 students enrolled in six allied health program (medical arts, medical dietetics, medical laboratory, medical records administration, occupational therapy and physical therapy). The Myers-Briggs Type Indicator was used. Students tended to have higher feeling versus thinking scores and higher judging versus perceiving scores. Those with direct patient contact tended toward extroversion and were distributed equally over the sensing-intuition scale.

Learning Style Models and Learning Style Assessment
Instruments

Cognitive style affects how students approach problem solving situations which directly impacts individual learning style. The terms learning style and learning preference are often used interchangeably. According to Curry (1983), one of the difficulties preventing progress in application of information gained from learning style assessments is the confusion of definitions and the wide scope of behavior which instruments claim to predict. To assist in organizing this confusion, Gorham (1986) defines style elements as falling into two categories: 1) those elements which describe conditions under which the student is most comfortable and *prefers* to learn and 2) factors which influence his or her *ability to process* information and which must be taken into consideration when considering how information is to be decoded and stored. These categories help to shed light on the two types of learning style assessment models: instructional preference models and information processing models.

Instructional preference models deal directly with assessment of conditions and modes of learning (teacher centered versus student centered instruction). These models and assessment instruments are useful when one wants information which can be used to design teaching-learning situations for individual learners. Information processing models deal with the intellectual approach people take to assimilate information (abstract versus concrete thought processes). These models and instruments are useful when

educators want information that can be used to describe and enhance the thinking or intellectual approach learners take to process information (Merritt, 1983).

Curry (1983) reviewed 21 learning style models. Of the 21, he selected ten which "demonstrated sufficient reliability and validity to be considered seriously" (p 7). These instruments were then classified into a three tiered organization, the first tier being the most stable and the third tier being the least stable (Table I). The most stable instruments and constructs were classified as "Cognitive Personality" elements and include Witkin's field dependence-independence model and the MBTI, discussed previously.

The second tier is labeled "Information Processing Style." These models describe an individual's intellectual approach to assimilating information. One of the instruments classified in this tier is David Kolb's Learning Style Inventory used in this study to measure modes of information processing in adults. Also recommended is the Swassing-Barbe Modality Index used frequently with young children (but has some history with adults) to measure perceptual modality strengths. The least stable group of instruments are the Instructional Preference types. Curry includes in this group the Renzulli-Smith Learning Styles Inventory which assesses student preferences for teaching techniques (lecture, discussion, drill, recitation) and other methods such as instructional games, independent study and programmed

Table I
Learning Models and Assessment Instruments

Model	Assessment Instrument
Adult Cognitive Style	Myers-Briggs Type Indicator (MBTI)
Information Processing	Kolb's LSI Swassing-Barbe Modality Index
Instructional Preference	Renzulli Smith Learning Style Inventory Dunn-Dunn and Price Learning Style Inventory Grasha-Reichman Student Learning Style Questionnaire Canfield's Learning Style Inventory

Adapted from Curry (1993).

instruction. One of the most popular broad-gauged instruments of this type is the Dunn, Dunn and Price Learning Style Inventory used frequently by secondary school educators. This inventory provides a profile of environmental preferences (sound, light, temperature), sociological preferences (self versus peer), and physical needs. This instrument is often used in conjunction with the related Productivity Environmental Preference Survey which is adapted to assess adult preferences. A third instrument discussed by Curry is the Grasha-Riechman Student Learning Styles Questionnaire used most often at college level. Students are asked to scale 90 statements about the likes and dislikes in instructional environments and materials. Not mentioned in Curry's review is Canfield's Learning Style Inventory which can also be classified as an instructional preference type inventory. This self report instrument has been used to study in the past to study allied health students' learning preferences.

Although not as stable as the Cognitive Personality type or the Information Processing type, the Learning Preference type assessments have the advantage of enabling the instructor to make specific alterations to suit individual student preferences.

Learning Preference Styles Among Allied Health Students

Several studies have been conducted to identify the instructional preferences of health care students. In a study carried out by Payton, Hueter and McDonald in 1979,

Canfield's Learning Style Inventory, a self-report learning preference inventory, was administered to a sample of 1099 students enrolled in entry-level physical therapy programs. The study revealed that physical therapy students preferred friendly relations with teachers, detailed information about coursework, people-oriented content, and learning by direct experience and listening modes. Allied health students enrolled in a number of allied health disciplines were investigated by Rezler and Rezmovic in 1981 using the newly developed Learning Preference Inventory. Students preferred concrete, teacher structured learning situations. Vittetoe (1983) studied 68 medical technology students and 32 physical therapy students from one university using the Learning Preference Inventory. Results indicated that these students also preferred concrete, teacher structured learning situations. Rogers and Hill (1980) had similar results with a sample of occupational and physical therapy students. Rahr (1987) used Gregorc's Learning Style Delineator and his own learning preference instrument to study learning styles and preferred learning environments of allied health and nursing students at the University of Texas at Galveston. The predominant learning style was concrete-sequential for physical therapists. Favored learning activities were note-taking, and lecture and laboratory in brightly lit settings. It is interesting to note that, as is often the case, learning style was not predictive of achievement. Table II summarizes these

Table II
Instructional Preferences Among Various Allied
Health and Nursing Students

Student Population	Measurement Instrument	Instructional Preferences
Allied Health	Learning Preference Inventory (Rezler & Rezmovic, 1981)	Concrete, teacher structured learning conditions*
Allied Health	Learning Preference Inventory (Vittetoe, 1983)	Concrete, teacher structured learning conditions*
Physical Therapy & Occupational Therapy	Learning Preference Inventory (Rogers & Hill, 1980)	Concrete, teacher structured learning conditions*
Allied Health & Nursing	Gregorc's Learning Style Delineator (Rahr, 1987)	Concrete sequential*
Physical Therapy	Canfield's LSI (Payton, Hueter & McDonald, 1979)	Friendly relations with teachers Detailed course information People oriented Experiential*

*Indicates Physical Therapy students in sample

studies and the results.

Not only have health care students been studied with regard to the conditions under which they prefer to learn, efforts have also been directed toward discovering the modes in which allied health and medical students process information. The instrument most often used to assess information processing style was Kolb's Learning Style Inventory (LSI).

Kolb (1984, p. 140-145) theorizes that people have four basic modes of processing information which shape individual learning process: the affective mode, the perceptual mode, the symbolic mode and the behavioral mode. The modes we use are shaped by heredity, life experience and the demands of our environment. In childhood, one may learn primarily in one mode only. As we grow older, we learn by integrating all four modes. The hallmark of creativity is good integration of all four modes. Kolb outlines three stages of development in terms of the maturation of learning abilities:

- 1) Birth through adolescence is called the Acquisition Stage. Basic learning style is developed in this stage through the growth of the individual's abilities and cognitive structure. Kolb (1984) suggests that student attitudes and learning orientations are shaped by early educational experience because early education teaches students how to learn.

- 2) Formal education (at the secondary and post-

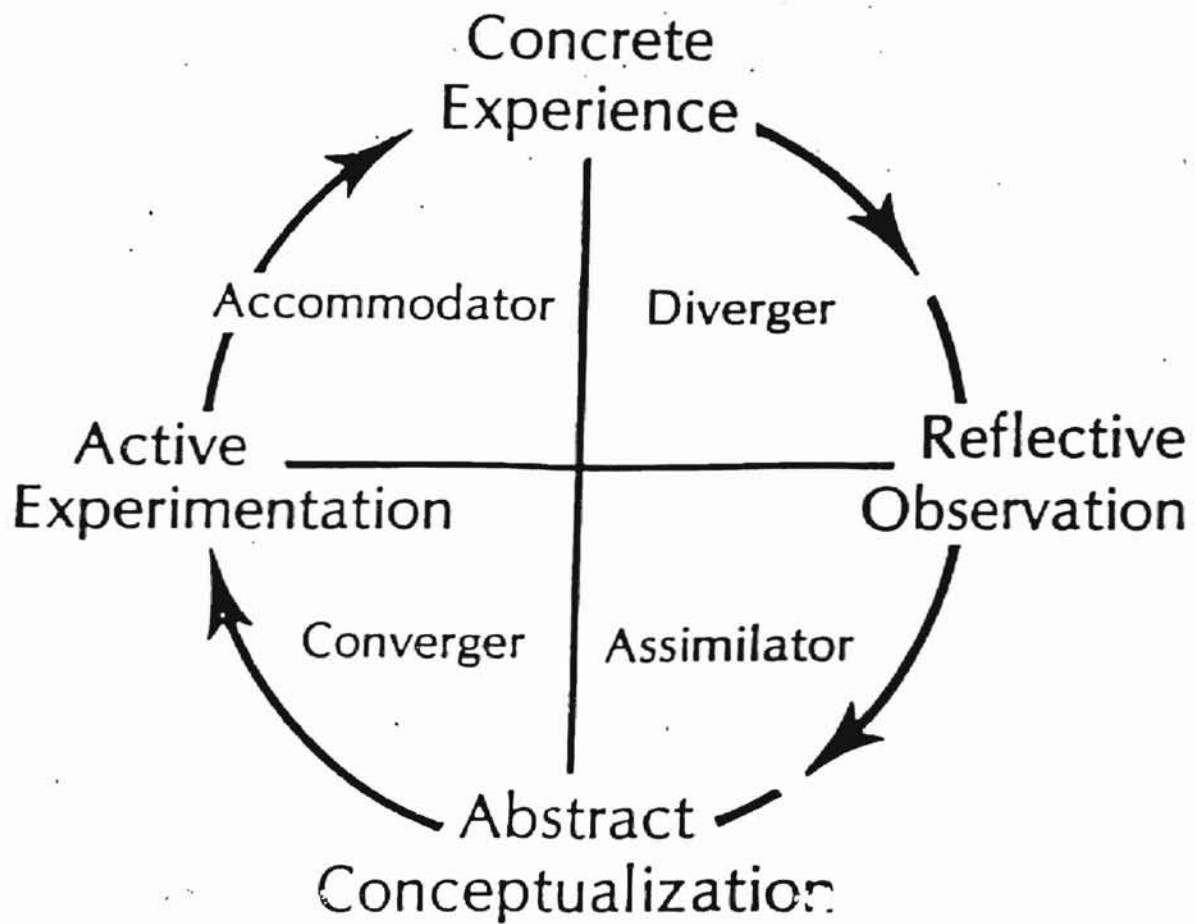
secondary level through work in adult life is called the Specialization Stage. Early educational experiences are generalized, but beginning in high school and particularly in college, specialization of learning begins to develop. Because this specialization is in the realm of social knowledge, Kolb (1984) believes that there is a relationship between learning style and the educational specialty or discipline students choose to enter. The individual's abilities and personal characteristics coupled with the demands of the environment are closely matched in this stage. Interaction between personal experience and environmental and social demands mold learning style. Kolb (1984) hypothesizes that individuals tend to select environments which are consistent with their personal characteristics and preferred learning style. An individual's career can, therefore, be seen as an extension of learning style developed through previous experience.

3) The final stage encompasses mid-career and continuing education and is termed Integration. In this stage individuals are torn by social demands on one hand and the need for personal fulfillment on the other. Learning style shifts to appreciate life experiences to the fullest, evaluate activities and make choices. An increased awareness of self often accompanies this stage. The individual may now use learning modes employed less frequently in the past as new goals and interests emerge. This self-evaluation and growth often characterize the

"adult-learner" and a fully integrated learning style is developed. (Kolb, 1984).

Kolb's model of experiential learning theory is represented in a cycle with two bipolar dimensions (Figure 1). The first dimension is labeled Concrete Experience (CE) versus Abstract Conceptualization (AC) and describes how important immediate and past experiences are to an individual's unique process of learning. Those who rely more heavily on immediate experience are likely to use processes consistent with Concrete Experience while those who prefer to emphasize past experiences to learn will rely more on the Abstract Conceptualization half of the learning cycle. The second bipolar dimension opposes Active Experimentation (AE) and Reflective Observation (RO). Those who prefer a more active orientation to learning will prefer the AE portion of the cycle while those who are more passive or reflective in their learning will prefer the RO portion (Kolb, 1974). Kolb's model is dynamic in that learners begin with one mode of processing information and cycle through the remaining three. For example, learning may begin with concrete experience by performing an unfamiliar task. The student moves to the reflective mode by thinking and hypothesizing about that experience which leads to the formation of some abstract generalizations which may result in his attempting to modify his performance when attempting to perform the task a second time. Kolb believes that learning orientations and styles are highly individualized and are

Figure 1. Kolb's Learning Cycle



Adapted from Kolb (1985b, p. 9)

products of a complex combination of biological and learned processes. All students have some preferences for learning modes. Some may prefer to reflect on a recent experience rather than use trial and error methods that are more prevalent with an active orientation. Ideally, mature learners move through all four cycles with equal ease. Realistically, students generally have one or two preferred modes of learning and some may even overemphasize a particular mode finding it difficult to learn when it is necessary to employ a less favorite mode (Kolb, 1974).

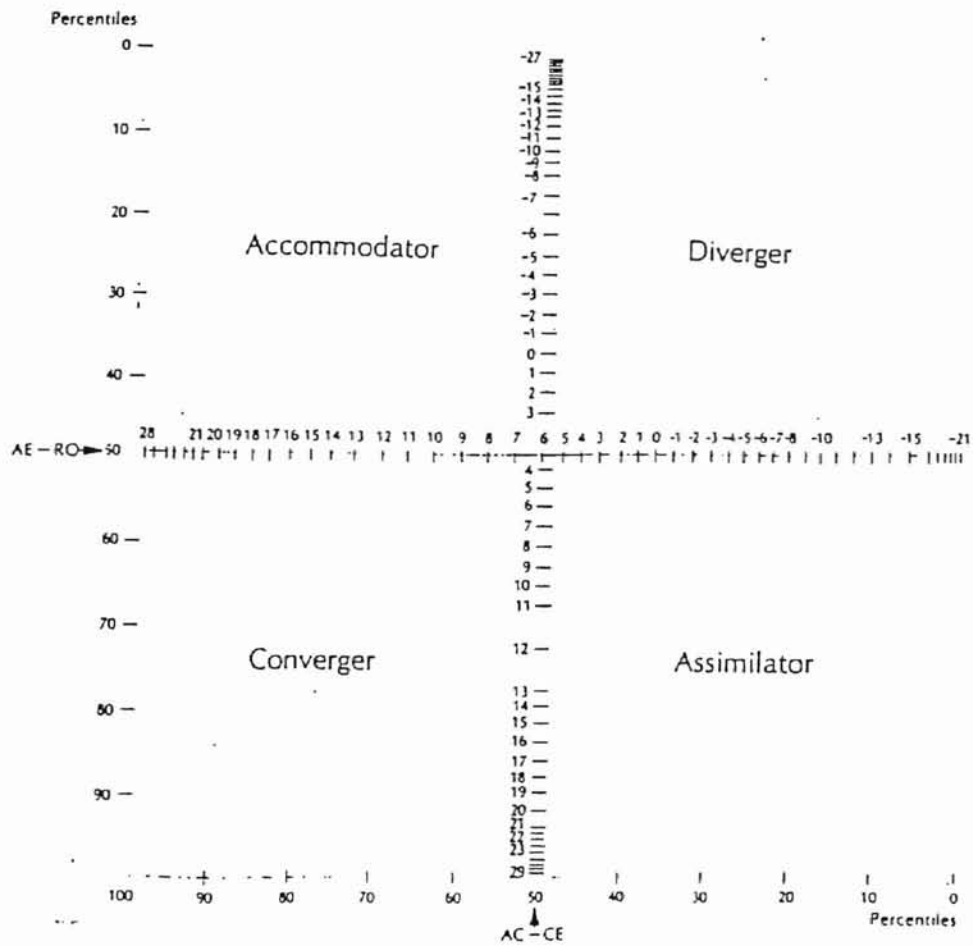
Kolb's Learning Style Inventory

The Learning Style Inventory was designed by David Kolb to measure his experiential learning construct. The original measure was published in 1976 and is still in use. The instrument was refined in 1985 and is often referred to the LSI II or the LSI 1985. This version is the one most often used to measure learning style today. In her article reviewing the use of the Kolb instrument in studying nursing student learning styles, DeCoux (1990) correctly points out that one of the roadblocks towards establishing good reliability and validity for this instrument is that researchers fail to note which form of the LSI they use.

The LSI is a self-report instrument derived from Kolb's experiential learning theory. It is designed to measure individual learning style. It is a twelve item, self-description questionnaire which asks the respondent to rank order four words in a way that best describes his or her

learning style. One word in each column corresponds to one of four learning styles: concrete experience (feeling), reflective observation (watching), abstract conceptualization (thinking) and active experimentation (doing). The rankings are then summed in four columns and combined to give two orientation scores: abstract conceptualization/concrete experience and active experimentation/reflective observation. If the individual has a positive score on the AC/CE scale, that indicates a more abstract learning style while a negative score indicates a more concrete learning style. In the same manner, a positive AE/RO combination score indicates a more active learning style, while a negative score characterizes a more reflective style. By plotting the two combination scores on two intersecting axes and locating the point of intersection (Figure 2), students can determine their learning style type by pinpointing the location in one of four quadrants. The quadrants are labeled: Accomodator, Diverger, Converger and Assimilator (Kolb, 1981). It is important to recognize that learning *orientation* is an individual's relative reliance one or more of the four learning styles: concrete experience, reflective observation, abstract conceptualization and active experimentation. The learning *style type* is the combination of the orientations. Another error often made by researchers is the confusion of these terms and their relative meanings (DeCoux, 1990).

Figure 2. Kolb's Learning Style Type Grid



Adapted from Kolb (1985b, p. 6).

In developing the LSI, Kolb grouped undergraduate majors into three categories: arts (English, foreign language, education/liberal arts, philosophy, history and music, (n=137); social science (psychology, sociology/anthropology, business, economics, political science, n=169); and physical science (engineering, physics, chemistry, mathematics and other sciences, n=277). After administering the test, he accurately predicted that students majoring in the arts would score high on the concrete experience/reflective observation scales and would therefore be classified as divergers. Students with majors in the physical sciences would be classified as convergers with scores high in abstract conceptualization and active experimentation while those students with majors in the social sciences would fall somewhere in between. Social science and physical science majors did not differ significantly on the AE/RO dimension.

Kolb (1985) contends that human service disciplines have concrete, people oriented learning orientations and predicts that physical therapists will fall into the Accomodator learning style inventory. Kolb also believes that women tend to be more concrete than men and that the tendency towards abstractness increases slightly as one grows older. He states that the tendency to use active experimentation as a learning mode increases as a student progresses academically (Kolb, 1985).

Construct Validity and Instrument Reliability in Style Assessment

Although recommended and widely used, learning style assessment instruments are not without flaws which should be taken into consideration. Sewall (1986) reviewed the Myers-Briggs Type Indicator, the Gregorc Style Delineator, the Canfield Learning Styles Indicator as well as the Kolb LSI and found that there were "significant measurement and related technical problems present in all the instruments reviewed" (p. 58). Sewall suggests a wider normative base for all assessment instruments including a well defined sample of adult continuing education students and more complete development of theoretical constructs. Since estimates of reliability are somewhat unstable for even short periods of time for all four instruments, a greater emphasis should be placed on the homogeneity of the instrument from a single administration rather than using it as a predictor of future preference. Ipsative scores produced by these measures appear to be inflating the validity studies. In reviewing the reliability of the 1976 version of Kolb's LSI, Hunsaker (1980) found the instrument lacking in reliability and cautions against using the LSI for making broad judgements about educational practices and career predictions. However, she also states that the learning model itself appears to "receive enough support to warrant further use and development" (p. 151).

In a similar review of six instruments of learning

style assessment, Rule and Grippen (1980) voice similar concerns with regard to instrument stability, but also offer some practical advice.

Though. . . length of existence does not necessarily mean the instrument is any more valid or reliable than its newer counterparts. What the older instruments do have is the vast amount of available information that, when properly examined provides the basis for informed choices concerning the instrument user; e.g., the theoretical "fit", reliability and validity for the proposed population sample, and how to best interpret results. (p. 18)

Information Processing Styles of Allied Health and Medical Students as Measured by Kolb's LSI

The following describes studies of health care student populations which have been carried out using Kolb's LSI to measure information processing style. Plovnick investigated the learning styles of 64 senior and 72 freshmen medical students using Kolb's LSI. Fifty-six percent of the sample were classified as convergers, preferring abstract conceptualization and active experimentation orientations to learning. Similar results were found by Wunderlich and Gjerde (1978) studying 109 physicians and 44 residents. Forty-six percent of that population also chose converger learning styles.

Converger was also the predominant learning style for physical therapists, dieticians, medical technologists and

occupational therapists studied by Bennett (1978) using Kolb's LSI. Gary (1984) found a similar orientation present when studying a large sample (n=501) pharmacy students. Nurses were found to have an accomodator learning style which combines concrete experience with active experimentation.

The relationship between learning styles, as measured by Kolb's LSI, and preference for instructional activities was studied for 163 dental hygiene students and 26 faculty members. Most of the students and the faculty were identified as being accomodators or divergers. Different learning style groups preferred different learning activities. Interestingly, faculty were able to predict their students' predominant learning style (Carrier, Newell & Lange, 1982). Similarly, Laschinger (1986) found that third year baccalaureate nursing students had a concrete learning orientation. Sixty-two percent were found to have either a divergent or accomodator learning style. In contrast, 56% of the baccalaureate nursing students studied by Highfield (1988) preferred an assimilator learning style which has a more abstract orientation. Haislett, et al (1993) also found that baccalaureate students (n=100) who were studied to determine the relationship between grade point ratio and learning style, were mainly classified as assimilators and divergers. In addition, the assimilator/diverger group had significantly higher grade point ratio. Barb (1991) chose the LSI 1985 to investigate

the learning style of entry-level physical therapy students (n = 167). The predominant learning style was found to be assimilator (a combination of reflective observation and abstract conceptualization).

In summary, there are no clear trends in learning styles or learning preferences for nursing students or allied health students as a whole. Those involved in health careers exhibit a wide range of learning styles. However, there appear to be a few similarities present in learning styles and preferences of physical therapy students based upon the research done to date. The chart on the following page summarizes the findings (Table III). Learning preferences seem to be for teacher-centered, well-organized learning environments. Physical therapy students tend to have an information processing style that is more abstract than concrete as measured by Kolb's LSI. At the present time, there is no research reported using physical therapist assistant students as subjects either as a succinct group or as part of a larger population.

The Effect of Gender, Age and Previous Educational

Experience on Learning Style

Kolb (1984) contends that women tend to have a more concrete learning style, while men tend to be more abstract. He also believes that there is a slight trend towards abstractness as people grow older and that the tendency toward the active experimentation learning mode increases as one progresses academically.

Table III
Information Processing Styles Among Health Care Students
According to Kolb's Learning Style Inventory

Student Population	Investigator	Learning Style
Medical	Plovnick (1975)	Converger (active/abstract)
Medical	Wunderlich & Gjerde (1978)	Converger (active/abstract)
Allied Health	Bennet (1978)	Converger (active/abstract)*
Pharmacy	Gary (1984)	Converger (active/abstract)
Dental Hygiene	Carrier, Newall & Lange (1982)	Accommodator (active/concrete) Diverger (reflect/concrete)
Nursing	Laschinger (1986)	Accommodator (active/concrete) Diverger (reflect/concrete)
Nursing	Highfield (1993)	Assimilator (reflect/abstract) Diverger (reflect/concrete)
Nursing	Haislett (1993)	Assimilator (reflect/abstract)
Physical Therapy	Barb (1991)	Assimilator (reflect/abstract)*
Allied Health	Katz & Heinmann (1991)	Assimilator (reflect/abstract)*

*Indicates Physical Therapy Students in sample

Unfortunately, the existing research using health career students as subjects has been inconclusive for most of these suppositions. Neither sex, age, nor educational background were found to have significance when compared with learning style as measured by the LSI (Vittetoe & Hooker, 1983; Highfield, 1988; Barb, 1990). Although Barb (1991) found no predominance of a distinct learning style among males or females in his study of physical therapy students, males in his study were found to be significantly more abstract in their learning orientation than females. Using the Student Learning Style Scale and a self-developed demographic instrument, Miller (1990) found that when surveying practicing physical therapists, 90% classified themselves as conscientious and 82% reported their learning style as collaborative and participatory. Miller found no relationship between learning style and any demographic information.

It appears that there is very limited support for Kolb's premise that age and previous educational experience have an effect of learning style of health care students and health care practitioners. There does seem to be comparatively more support for the hypothesis that gender has an effect on learning style.

Learning Style and Career Choice

According to Kolb's experiential learning theory, an individual's personal characteristics and the demands of the environment have a causal effect on learning style. In

addition, people tend to choose environments which are compatible with their preferred learning style. In that way, an individual's career choice is closely related to learning style (Kolb, 1984).

Taken as a whole . . . career choices tend to follow a path toward accentuation of one's specialized approach to learning. Learning experiences congruent with learning styles tend to positively influence the choice of future learning and work experiences that reinforce that particular learning style.

(p. 176)

Kolb (1981) suggests that human service disciplines have concrete, people-centered learning orientations. He predicts that physical therapists will fall into the accomodator learning style quadrant.

In a replication study, the LSI was given to 200 practicing physicians and medical students. Contrary to previous findings, there was no association between learning style and career choice in medicine (Wunderlich & Gjerde, 1978). In contrast, in a study which used a learning preference inventory to study physicians, differences were found among doctor's preferences for learning and interacting with others according to different career specialties (Jewett, et al, 1987).

As part of the Continuing Professional Education Development Project at Pennsylvania State University, the

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learning styles of 148 practicing professionals (accountants, architects, clinical dietitians and nurses) were investigated using Kolb's LSI. It was concluded that the LSI did have some ability to correlate career choice with learning style in a group of mature practitioners. As a result, researchers were able to develop efficient learning packages for the four professions studied (McCart, 1985).

To summarize, the existing research on learning style and health care education presents a rather confusing array. Different instruments of varying stability are used to measure a wide range of traits with conflicting results in many cases. To complicate the issue further, there is not a sufficient amount of research done with any one measure of learning style to develop a good normative sample for comparison. It is clear, however, that teaching style, instructional methods and materials do have an effect on student achievement. This suggests that effective teaching is a matter of finding a correct match between the learning styles of the student and the teacher (Sheffield, 1974; Gregorc & Ward, 1977; Conti & Welborn, 1986). Educators who wish to maximize the teaching/learning process do well to recognize individual preferences and implement activities which best assist students. The notion of improving instructional methods and outcomes by addressing the obvious differences in the way students learn seems ample reason to continue to investigate and add to the body of knowledge.

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CHAPTER III

METHODOLOGY

Research Design

An experimental approach was used to describe a convenience sample of physical therapist assistant students. The following were the objectives of the study:

- 1) To determine the predominant learning style of first year physical therapy assistant students.
- 2) To determine if there is a relationship between student learning style and age.
- 3) To determine if there is a relationship between student learning style and gender.

Sample

The sample population of this study consisted of students enrolled in the second semester of the first year of the Physical Therapist Assistant Program at Tulsa Junior College from 1990 through 1995. The convenience sample was a cluster type which included 96 students. Demographic data on student age and gender was gathered from existing student records.

Data Collection

The data was collected during the second semester of the program during a regularly scheduled class. The inventory was administered by the instructor who is also the author of the study. A statement regarding student participation and confidentiality was read to each class previous to the administration of the inventory (Appendix

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A). Students were told that the instrument that they were about to fill out was an assessment to help them identify their preferred modes of perceiving and processing information. Students were also told that the results of the research would be used by the instructor and others to improve curriculum preparation and assist in developing instructional materials and methods for physical therapist assistant students. Students were assured that the inclusion of their test results in the research project was strictly voluntary and if they chose not to participate, they should not return the original inventory to the instructor but should retain it for their own use. When students had completed the inventory and the analysis, they returned the originals to the instructor who assigned an identification number to each inventory. The inventories were copied and the originals returned to the students.

The corresponding demographic information on student age and gender was obtained from student records. Student names were then replaced with the assigned identification number, thus assuring anonymity of the participating students. If the student did not return his or her inventory to the instructor, he or she was not included in the study. Since the data used in the study could not be identified by name, there was no way to determine individual student participation.

Evaluation Instrument

The instrument used for evaluation was Kolb's Learning

Style Inventory 1985 purchased from McBer and Company, Boston, Massachusetts (Appendix B).

Kolb (1981, p. 5-6) described four specific learning styles based upon the learner's preference for perceiving and processing information. They are: 1) Diverger, 2) Assimilator, 3) Converger, and 4) Accomodator. Respondents are asked to complete twelve items by rank ordering the sentence endings which best describes how they would go about learning something new. Students are asked to give a rank of four (4) for the sentence ending that describes how they learn best, a rank of one (1) for the sentence ending that they least prefer, a rank of three (3) for their second favored ending and finally, a rank of two (2) is assigned to the remaining ending. Instructions for completing the inventory are also written in the inventory booklet itself for students to refer to while completing the inventory.

After all items are completed, the sums of the scores in each of four categories which correspond to the learning styles: 1) Concrete Experience (CE) 2) Reflective Observation (RO) 3) Abstract Conceptualization (AC) and Active Experimentation (AE) were calculated. The resulting raw scores range from 12 to 48. Students plot and connect their four scores on "The Cycle of Learning" to form a shape that looks roughly like a kite. This operation helps students to understand their relative strengths and weaknesses in learning. The explanation states that different learners start at different places in the cycle.

To be most effective in learning, learners should progress through each stage rather than relying on just one mode to assimilate information (Kolb, 1976, p. 4).

The AC/CE combination scores were obtained by subtracting the CE score from the AC score. The AE/RO combination score was obtained by subtracting the RO score from the AE score. Students were assured that it is possible to have a negative score in either case. A positive score in the AC/CE scale indicates a preference for an abstract learning style while a negative score indicates a learning style that is more concrete. Likewise, a positive or negative score on the AE/RO scale indicates a more active or reflective style, respectively (Kolb, 1981).

Once the AC/CE and AE/RO combination scores are calculated, they are plotted on the Learning Style Type Grid. The AC-CE score is plotted on the vertical axis. The AE-RO score is plotted on the horizontal axis. It is important to note that the two axes do not intersect at zero. The AE-RO axis intersects the AC-CE axis between the points 3 and 4, which the AC-CE axis intersects the AE-RO axis at AE-RO point 6. Drawing perpendicular lines from the plotted points provides an intersecting point in one of the four quadrants which indicates the student's learning style type (Kolb, 1981, p. 6-7). The characteristics of each of the four types are then discussed:

- 1) Convergents' greatest strengths are problem solving decision making and the practical application of ideas.

These people prefer dealing with facts and technical tasks rather than interpersonal issues.

2) Divergers' strengths lie in their imaginative abilities and the ability to view situations from several points of view and to organize many related variables into a meaningful whole. These people are interested in other people and tend to be oriented towards values and feelings.

3) Assimilators' greatest strength is the ability to create abstract models and use inductive reasoning. These people are less focused on people and more concerned with ideas and concepts. It is important to them that theories are logical and precise.

4) Accommodators' greatest strength lies in doing things and getting involved in new experiences. These people like to seek out new opportunities and are risk-takers. They like to solve problems using a trial and error approach. These people like to interact with other people but may be impatient with those who are more deliberative (Kolb, 1984, p. 76-78).

The instrument ends with an explanation of how to apply learning style to the problem solving cycle and career choices (Kolb, 1981, p. 9-12).

Instrument Reliability and Validity

Kolb (1985, p. 4-5) demonstrated coefficients of 0.75 - 0.80 for the split-half reliability of the LSI 1985 using the Spearman-Brown prophecy formula. Geller (1979) and Wunderlich & Gjerde (1978) report test-retest reliability

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coefficients between 0.72 and 0.84 on the combination scores providing support for the reliability of the instrument. Split-half coefficients of approximately 0.80 are consistent with most psychological self-report instruments (Kolb, 1976, p. 14). Wunderlich and Gjerde (1978) found test-retest correlations from 0.44 to 0.72 which were significant at the 0.05 level. Kolb (1981 p. 4) reports that the four scales and combination scores show good internal reliability ranging from 0.73 to 0.88 using Cronbach's Alpha.

The validity of the LSI 1985 has been tested by correlating results with the Myers-Briggs Type Indicator, the Thematic Apperception Test, (TAT), measures of *n* Achievement, *n* Power, and *n* Affiliation, the FIRO-B, two graduate aptitude tests, a personnel aptitude test, and two creativity tests (Kolb, 1976, p. 27-31).

Data Analysis

Data were analyzed using descriptive statistics and the non-parametric test, Chi Square. Non-parametric tests were chosen because students in the sample are included secondary to a competitive selection process. The selection process at Tulsa Community College involves assessing student's likelihood of success in the program based upon ACT scores, accumulative grade point average, a writing sample, a structured interview and evaluation of interest by a clinical instructor observing student reactions in the clinical setting. Additional credit is given to students who have some work experience in a health care field.

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Therefore, members of the sample do not represent a normal distribution of students at Tulsa Community College. Because students are all selected using the same admission criteria, the sample is quite homogeneous, precluding the use of parametric statistical tests. The data collected in this study is nominal in nature which requires non-parametric statistical treatment (Key, 1993).

The Chi Square statistical test is used when the investigator is interested in "goodness of fit" between the observed number of responses for each category and the expected number of responses for each category that would occur by chance. In this case, the frequency of responses in each category is compared with a hypothetical population.

Determining Predominant Learning Style

Once students' individual learning styles were determined, students were grouped according to the four learning style categories defined by Kolb: Converger, Diverger, Assimilator or Accomodator. Numbers in each category were summed and expressed as a percentage of the whole group. In this way, a predominant learning style for the group could be identified. Single sample Chi Square analysis was used to test for significance.

Determining the Degree of Abstract Learning and Active Learning Preferred

To determine the degree of concrete or abstract learning preferred by students, individual AC/CE scores were summed and a mean AC/CE score was determined for the sample.

Similarly, to determine the degree of active or reflective learning preferred by students, individual AE/RO scores were summed and a mean AE/RO score was obtained. Once again, statistical significance was tested using single sample Chi Square analysis.

Analysis of the Relationship between Learning Style and Student Gender and Age

Using the demographic information collected from student records students were divided into three arbitrary age categories: 18 - 29 years; 30 - 41 yrs.; and students over 41 years of age. In comparing frequencies of occurrence in two or more categories of two or more groups, the statistical test of two-way Chi Square analysis is recommended (Key, 1993).

Demographic information was also used to assign students to the appropriate gender group. Two-way Chi Square analysis was also used to test for significance in the relationship between student gender and learning style.

CHAPTER IV

Findings

Predominant Learning Style

When the AC/CE and AE/RO combination scores for each student were plotted on the learning style grid, an individual learning style was determined. A total of 37 students out of the 96 in the sample reported an Assimilator type learning style. Expressed as a percentage, 39.4% of the sample were categorized as Assimilators. Single sample Chi Square analysis of the frequency of distribution of students' learning styles across the four categories gave a value of 9.750 which was significant at the .05 level (Table IV). The predominant learning style of this sample proved to be an Assimilator style showing preference for more abstract, reflective learning activities (Figure 3).

The individual AC/CE combination scores of the LSI 1985 were plotted on the vertical axis of the Learning-Style Type Grid. The scores reflect the degree to which the student reported preferring to learn in either a concrete or an abstract mode. Scores toward the negative range indicated a preference for more concrete learning situations while those toward the positive direction indicated a preference for more abstract modes. Frequencies for the individual AC/CE are listed in Table V. The individual combination scores were summed and a mean AC/CE score for the sample was determined. The mean AC/CE score for this

Table IV
Frequencies of Learning Styles of First Year Physical
Therapist Assistant Students at Tulsa Community College

Learning Style	Number of Students	Percentage of Sample
Accomodator	n = 18	18.8%
Assimilator	n = 37	38.5%
Converger	n = 19	19.8%
Diverger	n = 22	22.9%

Figure 3. Learning Styles of First Year Physical Therapist Assistant Students at Tulsa Community College

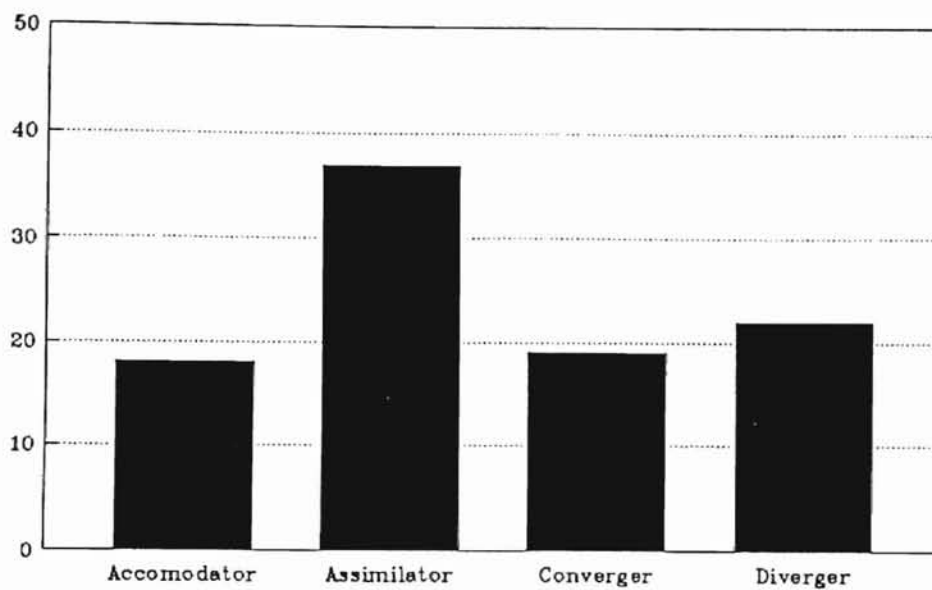


Table V

Frequencies and Mean AC/CE Scores of First Year Physical
Therapist Assstant Students at Tulsa Community College

AC/CE Values <i>n</i> =	Number of Students <i>n</i> =	AC/CE Values <i>n</i> =	Number of Students <i>n</i> =
- 22.0	1	11.0	3
- 13.0	2	12.0	1
- 11.0	3	13.0	2
- 10.0	1	14.0	3
- 9.0	2	15.0	1
- 8.0	1	16.0	1
- 6.0	3	17.0	2
- 5.0	3	18.0	1
- 4.0	3	19.0	1
- 3.0	4	20.0	1
- 2.0	1	21.0	2
0.0	6	22.0	1
1.0	3	23.0	3
2.0	6	25.0	2
3.0	3	26.0	1
4.0	3	27.0	1
5.0	4	28.0	2
6.0	2	29.0	1
7.0	8	32.0	1
8.0	1	Total	96
9.0	5		
Mean AC/CE	6.240	Chi Square	45.792
		<i>df</i>	40

sample was 6.240 (range = +4 to +29) indicating that this sample of physical therapist assistant students preferred a more abstract learning orientation (Table V). The AC/CE scores failed the single sample Chi Square test of significance with a value of 47.50.

The AE/RO score is represented on the horizontal axis of the Learning Style Grid illustrating learning preferences which ranged from the more active learning orientations with positive scores to a more reflective learning orientations and scores in the smaller and negative direction. The individual AE/RO frequencies are shown in Table VI. The individual AE/RO scores were summed and the mean AE/RO score for this sample was found to be 2.656 (range = +6 to -21) indicating that these students reported having a more reflective learning orientation (Table VI). Single sample Chi Square analysis of the individual AE/RO scores also failed to show statistical significance with a value of 45.792.

In Figure 4, the mean AC/CE combination scores and the mean AE/RO combination scores for the sample are plotted on the Learning Style Grid. It is interesting to note that though both sets of combination scores failed to show significance, there is a definite tendency towards abstract, reflective learning modes in this sample.

Relationship between Learning Style and Age

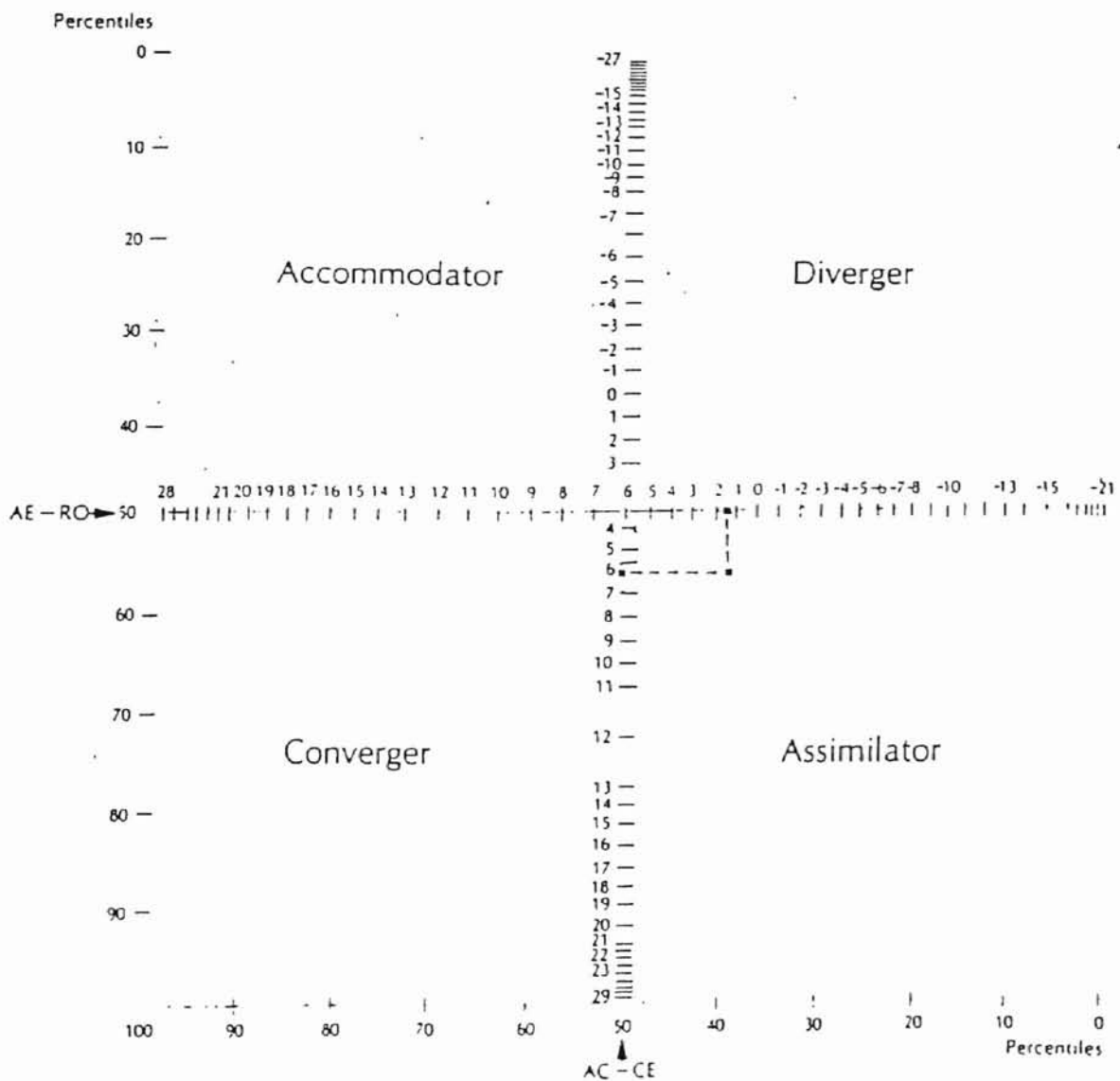
Based upon birth date information collected from existing student records, students were grouped according

Table VI

Frequencies and Mean AE/RO Scores of First Year Physical Therapist Assistant Students at Tulsa Community College

AE/RO Values <i>n</i> =	Number of Students <i>n</i> =	AE/RO Values <i>n</i> =	Number of Students <i>n</i> =
-27.0	1	3.0	1
-23.0	1	4.0	6
-20.0	1	5.0	4
-18.0	1	6.0	5
-17.0	2	7.0	2
-16.0	1	8.0	3
-15.0	3	9.0	4
-14.0	1	10.0	1
-12.0	1	12.0	2
-11.0	4	13.0	1
-10.0	1	15.0	7
-9.0	5	16.0	1
-7.0	1	18.0	4
-6.0	1	19.0	1
-5.0	5	20.0	4
-4.0	2	22.0	1
-3.0	1	25.0	1
-2.0	2	Total	96
0.0	3		
Mean AE/RO	2.656	Chi Square	47.50
		<i>df</i>	40

Figure 4. Mean AC/CE and AE/RO Scores of Tulsa Community College Physical Therapist Assistant Students Plotted on Kolb's Learning Style Grid



age: 18 to 29 years old ($n = 31$); 2) 30 to 41 years old ($n = 41$); and 3) students over 41 years old ($n = 23$). Next, the three age groups represented in the sample were compared with student learning styles (Table VII). Using two-way Chi Square analysis to test the data, the resulting value of 2.559 did not prove a significant relationship between age and learning style. Table VII also shows the percentage of students in each age group reporting a given learning style. No trends are apparent when the data are viewed in this way other than to note that older students tend to be more evenly distributed across the four learning styles than the younger students.

The Relationship between Learning Style and Gender

The same statistical test of two-way Chi Square, was used to compare students' learning style with student gender. There were 70 females and 26 males in the sample (Table VIII). The Chi Square value of 6.170, although much higher than the value for the learning style/age group comparison, was not indicative of a significant relationship between student learning style and gender. To view the data in another light, the percentage of males in the sample with an Assimilator learning style is 57.7%. The percentage of females in the sample reporting an Assimilator learning style is only 31.4%. Females were almost equally distributed across the four learning style categories while the majority of the males were Assimilators. This may indicate that males were comparatively more abstract and

Table VII
 Frequencies of First Year Physical Therapist Assistant
 Students at Tulsa Community College by Age

	18 - 29 yrs. n = 31	30 - 41 yrs. n = 41	>41 yrs. n = 23	Total
Accomodator	6	7	4	17
%Total	35.3%	41.2%	23.5%	100%
Diverger	6	11	5	22
%Total	27.3%	50%	22.7%	100%
Converger	7	7	5	19
%Total	36.8%	36.8%	26.5%	100%
Assimilator	12	16	9	37
%Total	32.5%	43.2%	24.3%	100%

Table VIII

Frequencies of First Year Physical Therapist Assistant
Students at Tulsa Community College by Gender

Learning Style	Females <i>n</i> = 70	% Females	Males <i>n</i> = 26	% Males	Total
Accomodator	16	22.8%	2	8.0%	18
Diverger	17	24.3%	5	19.2%	22
Converger	15	21.4%	4	15.4%	19
Assimilator	22	31.4%	15	57.7%	37

reflective in their learning styles than females in this sample.

CHAPTER V

Conclusions, Implications and Recommendations

It is of some interest that physical therapist assistant students appear to have a predominant learning style. Over 39% of the students in this sample expressed a preference for abstract conceptualization coupled with a reflective observation approach to learning. These results do not confirm Kolb's prediction that those who choose occupations in the human service disciplines, including physical therapy, have more concrete learning orientations. His prediction that these individuals will fall into the Accommodator (concrete - active) quadrant is not supported by this study.

Kolb maintains that people choose courses of study that fit their learning style (1984). Others have found that there are similar learning styles among students in similar courses of study (Laschinger, 1986; Vittetoe, 1983; Rahr, 1987; Katz & Heimann (1991) and Haislett, et al, 1993). Barb (1991) found a statistically significant number of physical therapist students in his sample shared a predominant learning style, specifically that of an Assimilator. In this sample of physical therapist assistant students, though there were students who had learning styles in all four quadrants of Kolb's learning style grid, a significant number of the students also had an Assimilator learning style. Given this information, there appears to be some support developing for the suggestion that PT and PTA

students exhibit similar learning styles, although not the one Kolb predicts.

There is an additional area of conflict in applying Kolb's theoretical construct to this study. Kolb describes an Assimilator as one who is "less focused on people and more interested in abstract ideas and concepts" (1981, p. 7). That characteristic is not generally observed in physical therapist assistant students, virtually all of whom profess a strong desire to work with people as a primary reason for entering the field in the first place (Reese, 1996). This observation seems to belie Kolb's premise that learning style and career choice are closely related. Further study is needed to confute this entirely, however.

The age of students did not appear to be related to learning style in any way. Though Kolb asserts that students grow more abstract in their learning style as they grow older (1984), that was not demonstrated in this study. In fact, the older students in this study were more equally distributed across the four learning styles than their younger cohorts. The conclusion to be drawn here is that, as long as one is dealing with adult learners, there may be less reason to be concerned about the wide variation in age in non-traditional classrooms than previously hypothesized. The results of this study indicate that gender and learning style are not significantly related according to Chi Square analysis. It should be noted, though, that a larger percentage of the males in the sample (57%) reported an

Assmilator learning style than the females (31%). Males in this sample appear to be more abstract and reflective in their approach to learning, a trend also identified by Barb (1991). It could be that in making decisions regarding teaching-learning methods in the classroom, the number of male students in the population is a variable to consider.

The Assimilator in the Physical Therapy Curriculum

Students with an Assimilator learning style are likely adept at transforming a large amount of information from multiple sources into a logical conceptual framework. They prefer to begin the learning cycle with demonstration rather than with more active "hands on" trial and error methods. Assimilators may also be very good at creative problem solving and brainstorming across a wide range of ideas.

These students are well suited for the way in which learning activities are conducted in formal learning environments found in most physical therapy curriculums. Traditional teaching methods employed in physical therapy education are structured to provide students with theories and background information for treatment from which they develop abstract conceptualizations. Opportunities are then provided for students to observe demonstrated techniques and follow with repeated practice. Finally, they apply the concepts and the skills in a clinical practicum. Students work from a rather passive base of reflection and conceptualization and move towards a more active mode of learning as the amount of clinical experience in the

curriculum increases. This is a very comfortable learning progression for the Assimilator, though the shift towards more active modes may prove difficult in some instances, depending upon how entrenched students are in their learning preferences.

Additionally, students spend a considerable amount of time critically observing human movement and patient response to treatment. Students must learn to develop acute observation skills and analyze what they see. Good problem solving ability is a necessity in formulating logical treatment procedures based upon those observations and upon theoretical constructs learned in the classroom. Students who are good at these types of activities find the skills attributed to an Assimilator learning style very useful, i.e., the ability to reflect on what is observed, the ability to assimilate a wide range of information and observations into a logical, concise model and the ability to make clinical decisions based upon that theoretical model.

At this juncture, a provoking question arises: do students select this field of work because they are good at these kinds of learning activities already or do they become good Assimilators because that is what their present environment demands? The alternative to the view that students come to this course of study with a predisposition for a particular learning style is that students shift learning style to fit the requirements of the course content

and learning activities. This phenomenon has been observed before. First year medical students show a definite shift in learning style from their first to their fourth year. In the beginning, first year students used abstract conceptualization as their preferred learning style but by their fourth year, the group had moved more towards an active experimentation mode, presumably in response to a change in the learning environment (Kolb, et al, 1974). It is also known that the majority of students, while having definite preferences about learning orientations, do have some flexibility in learning style. In fact, Kolb feels that the mark of a strong student is his or her ability to shift learning orientations according to the demands of the material and or learning tasks at hand (1984).

In summary, students are either coming to the PTA program at Tulsa Community College with a bias towards a particular learning style, possibly as a function of the selection process, or after admission they successfully make a shift in learning style and simply employ the style which best suits the requirements of their learning environment at the time. All things considered, the latter alternative seems the most plausible.

Implications for Planning Learning Activities and Curriculum Design

Whether students come to the Tulsa Community College Physical Therapist Assistant Program with a particular learning style or are molded by learning experience, it

seems a reasonable corollary that if a comparatively large percentage of students in a population exhibit a preference for a learning style, whatever the cause, then that bias ought to be taken into consideration when planning learning activities for that group. However, there are several ways in which learning style information can be used in the classroom to enhance learning for all students.

Since a significant number of students may tend to use an abstract conceptualization approach rather easily, that orientation can be used as a "home base" for planning learning. The use of diagrams, flow charts and models to help students form and visualize abstract concepts should be successful. Graham (1996) indicated that verbalizing concepts was important in gaining conceptual understanding in the physical therapy classroom. Group collaboration, study groups and discussion of concepts with peers help students to "grasp concepts at high levels of understanding" (p. 861). Discussion with faculty and clinical instructors help students internalize concepts and assists students in applying concepts to clinical practice. Students can work together in groups according to learning style. Allowing students to work with students who have a similar learning style gives them the opportunity to take advantage of their innate abilities as a focus or starting point for learning.

Students can use their tendency toward reflection to employ past or recent experiences as a framework or context for new information and concepts. Learning activities and

assignments can be structured in such a way as to encourage students to use their clinical experience, laboratory experience and even everyday life experience to help develop conceptual knowledge. Curriculum design which integrates clinical experience throughout the course of study rather than concentrated at the end provides students with opportunities for good contextual learning and application of concepts developed in the classroom. Using this pattern may also facilitate the required shift from a more reflective learning style employed in the classroom to a more active learning style required in the clinic.

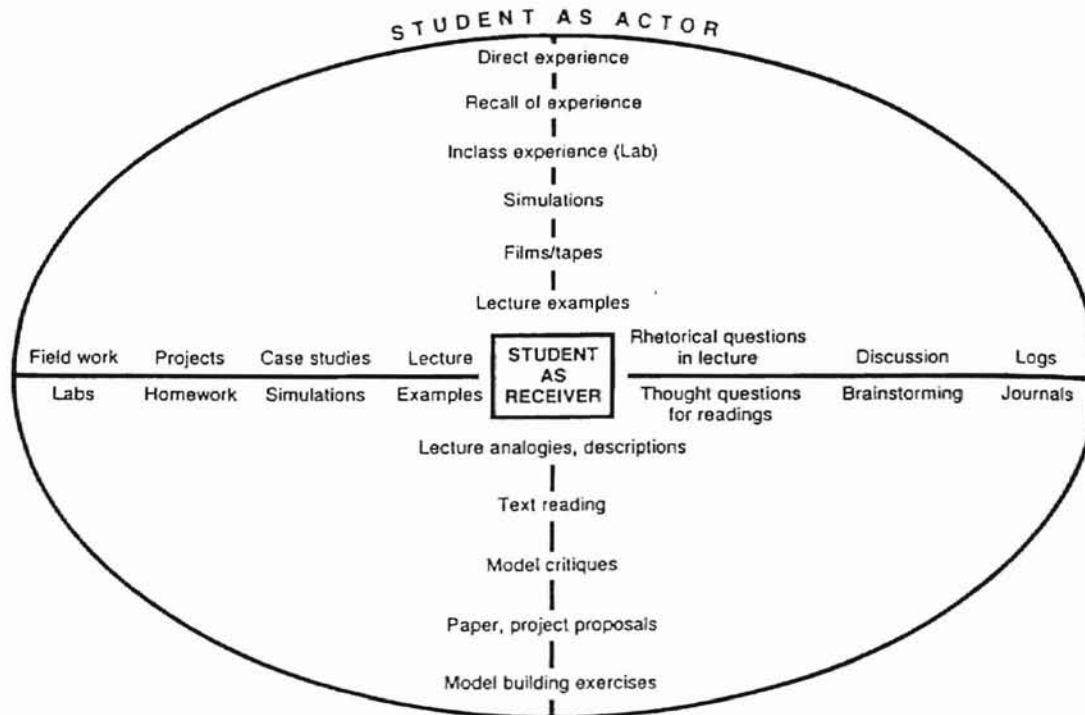
Alternatively, instructors may use student learning style information to form a more individual approach to learning and to encourage flexibility in learning orientations. In a discussion of implementation of learning style information in the classroom, Grasha (1990) suggests that the best way to use that information is by helping students understand their own learning style and by providing a variety of instructional strategies in an environments which encourages self-directed learning. For example, students may choose to learn new information either by listening to a lecture or video tape or by doing library work. Prepared worksheets which students bring to class may then be the basis for small group discussion to help students summarize materials or identify important points. Class time can then be used to help students analyze and expand their understanding. Simulated laboratory

experiments can be used to create more diversity in learning in the classroom (Dixon, 1985; Grasha, 1990) and are an excellent precursor for clinical experience. The advent of computer assisted learning and interactive learning software programs present some promising possibilities for self-directed learning. It becomes the responsibility of the student to employ learning activities which are best for herself or himself.

Kolb advocates helping students learn about their own learning style and using that information to become more well-rounded learners, able to switch easily from one learning orientation to another. Bernice McCarthy (1980) has designed an instructional approach to classroom teaching based on Kolb's learning theory. McCarthy's application outlines in detail how to structure learning in such a way as to move through all four quadrants in Kolb's Learning Cycle. Each of the four learning approaches are equally valued. In this way students are not only successful in the areas in which they are already facile but also learn to take advantage of learning activities which they might not be as likely to choose.

Svinicki & Dixon (1988) also describe a theoretical framework for organizing classroom activities based on Kolb's Learning Cycle. Beginning the learning cycle with concrete experience, the instructional sequence and moves clockwise through reflection, conceptualization, experimentation and application (Figure 5). At each of the

Figure 5. Organization of Classroom Activities Based on Kolb's Learning Cycle



four quadrants of the cycle, different learning activities are used. Activities are also varied as to the amount of student involvement required as Svinicki and Dixon maintain that some disciplines may rely more heavily on more active approaches to learning than others and those constraints are taken into consideration. This type of design can be used across a curriculum to sequence instruction throughout an entire course of study. In this way all students will find learning activities that suit their particular learning style at some point. In addition, using these kinds of teaching techniques should, theoretically at least, allow students to become stronger in their ability to learn in any given situation as the learning environment changes (i.e. from the classroom and laboratory to the clinic). In whatever way instructors decide to use learning style information, by designing learning activities which are comfortable for the majority of students, by assisting students in coping with changes in the learning environment, or by helping students use learning style information individually, having that information to begin with is an asset to the teaching-learning environment.

Recommendations for Further Study

Further research comparing student learning styles before entering a program with the results of a similar assessment upon graduation would help to clarify the issue of shift in student learning style. A longitudinal research design is suggested to determine whether the learning style

of physical therapist assistant students remains constant from the beginning to the end of the PTA course of study and then on into clinical practice. The demands of clinical practice may require an entirely different approach to problem solving and consequently affect learning style.

Data collection on previous work and student educational experience to explore the relationship of these factors to learning styles in the same population might provide some interesting insights into learning orientations. Examination of the relationship between learning style and achievement in this population is also worthwhile.

Finally, as suggested earlier, using Kolb's LSI 1985 (the revised version) to study the learning styles of physical therapist assistant students in other samples will add to the existing body of knowledge on the subject of learning style and provide stronger normative group for comparison.

BIBLIOGRAPHY

- Barb, D. (1991). The relations of learning styles and selected demographics of entry-level physical therapy students. Unpublished master's thesis. Wichita State University.
- Bennett, N. (1978). Learning styles of health professionals compared to preference for continuing education format. Unpublished master's thesis. University of Illinois, Urbana-Champaign, IL.
- Blagg, J. D. (1985). Cognitive styles and learning styles as predictors of academic success in a graduate allied health education program. Journal of Allied Health, 14(1), 89-98.
- Carrier, C. A., Newel, D. J., Lange, A. L. (1982). The relationship of learning styles to preferences for instructional activities. Journal of Dental Education, 46(11), 652-6.
- Cawley, R. W., Miller, S. A. & Milligan, J. N. (1976). Cognitive styles and the adult learner. Adult Education, 25(2), 101-116.
- Christensen, M., Lee, C. & Bugg, P. (1979). Professional development of nurse practitioners as a function of need motivation and locus of control. Nursing Research, 28, 51-56.
- Claxton, C. S. & Ralston, V. (1978). Learning styles: their impact on teaching and administration (Research Report N. 10). Washington, D. C.: American Association for Higher Education.
- Conti, G. J. & Welborn, R. B. (1986). Teaching-learning styles and the adult learner. Lifelong Learning, 8 20-24.
- Curry, L. (1983). An organization of learning styles theory construct. (ERIC Document Reproduction Service No. ED 235 185).
- DeCoux, V. M. (1990). Kolb's Learning Style Inventory: a review of its applications in nursing research. Journal of Nursing Education, 29(5), 202-7.
- Dixon, N. M. (1985). The implementation of learning style information. Lifelong Learning, 913, 16 - 20.
- Gary, M. (1984). An assessment of learning style among pharmacy students. American Journal of Pharmaceutical Education, 48(2), 134-40.

- Geller, L. (1979). Reliability of the Learning Style Inventory. Psychological Reports, 44, 555-567.
- Gorham, J. (1986). Assessment, classification and implications of learning styles in instructional interactions. Communication Education, 33(4), 411-17.
- Graham, C. L. (1996). Conceptual learning processes in physical therapy students. Physical Therapy, 76(8), 856-65.
- Grasha, T. (1990). The naturalist approach to learning styles. College Teaching, 38, 106 - 113.
- Gregorc, A. F. (1979). Learning/teaching styles: potent forces behind them. Educational Leadership, 36, 234-236.
- Haislett, J., Hughes, R. B., Atkinson, G., Jr. & Williams, C. L. (1993). Success in baccalaureate nursing programs: a matter of accommodation? Journal of Nursing Education, 32(2), 64-70.
- Highfield, M. (1988). Learning styles. Nurse Educator, 13(6), 30-33.
- Hunsaker, J. S. (1980). The experiential learning model and the Learning Style Inventory: an assessment of current findings. Journal of experiential learning and simulation, 2(3), 145-152.
- Jewitt, L. S., Greenberg, L. W., Joley, R. P., Goldberg, R. M., Speigel, C. T., & Green C. (1987). Another look at career choice and learning preferences. Medical Education, 21(3), 244-9.
- Katz, N., Heimann, N. (1991). Learning styles of students and practitioners in five health professions. The Occupational Therapy Journal of Research, 11(4), 238 - 244.
- Keefe, J. W. (1979). Learning style: an overview. In Student Learning Styles (p. 1-17), Reston, VA: The National Association of Secondary Principals.
- Key, J. P. (1993). Research design: course modules and readings for AGED 5980. Oklahoma State University, Agricultural Education Department.
- Kirby, P. (1979). Cognitive style, learning style and transfer skill acquisition. (Information series No. 195). Columbus, OH: Ohio State University, The National Center for Research in Vocational Education.

- Kolb, D. A. (1974). On management and the learning process. In Organizational psychology: a book of readings (2nd ed.). Englewood Cliff, NJ: Prentice Hall.
- Kolb, D. A. (1976). Learning Style Inventory: technical manual. Boston, MA: McBer and Company.
- Kolb, D. A. (1981). Learning Style Inventory: Self-scoring inventory and interpretation booklet. Boston, MA: McBer and Company.
- Kolb, D. A. (1984). Experiential learning: experience as the source of learning and development. Englewood Cliffs, NJ: Prentice Hall.
- Kolb, D. A. (1985). Learning Style Inventory 1985: technical specifications. Boston, MA: McBer and Company.
- Kolb, D. A. (1985b). Learning style inventory: self-scoring inventory and interpretation booklet. Boston, MA. McBer and Company.
- Laschinger, H. K. (1986). Learning styles of nursing students and environmental press perceptions of two clinical nursing settings. Journal of Advanced Nursing, 11, 289-294.
- McCart, C. L. (1985). Learning styles among established professionals. Paper presented at the Annual Meeting of the American Educational Research Association (69th Chicago, IL, March 31 - April 4, 1985). (ERIC Document Reproduction Service No. ED 261 086)
- McCarthy, B. (1980). The 4mat system: teaching to learning styles with right/left mode technique. Barrington, IL: Excel.
- Merritt, S. (1983). Learning styles: theory and use as a basis for instruction. In W. L. Holzemer (Ed.), Review of Research in Nursing Education: Vol. II, (p. 1-31).
- Messick, S. (1993). Human abilities and modes of attention: the issue of stylistic consistencies in cognition. Report No. ETS-RR-93-43. Educational Testing Service, Princeton, NJ. (ERIC Document Reproduction Service No. ED 385 603)
- Miller, M. (1990). Interrelationships of ego development, learning styles and selected demographics and personal experiential characteristics of physical therapists who attend continuing professional education courses. (Doctoral dissertation, University of Southern California, 1990). Dissertation Abstract International

52, 01-B, 182.

- Mitchell, C. A. (1988). One view of the future: Non-traditional education as the norm. Nursing and Health Care, 9, 186-190.
- National Commission on Allied Health Education (1980). The Future of Allied Health Education, Josey Bass, San Francisco, CA.
- Payton, O. D., Hueter, A. G. & McDonald, M. D. (1979). Learning style preferences: Physical therapy students in the United States. Physical Therapy, 59, 147-152.
- Plovnick, M. (1975). Primary care career choices and medical student learning style. Journal of Medical Education, 50, 849-855.
- Rahr, R. (1987). Basic learning styles and the relationships to achievement in allied health and nursing. (Doctoral dissertation, University of Houston, 1987). Dissertation Abstracts International, 49, 04-A, 940. (University Microfilms No. AAD88-11028)
- Reese, S. (1996). Personal communication on the selection of physical therapist assistant students at Tulsa Community College, November, 1996.
- Rezler, A. & French, R. (1975). Personality types and learning preferences in six allied health professions. Journal of Allied Health, 4, 20-26.
- Rezler, A. & Rezmovic, V. (1981). The learning preference inventory. Journal of Allied Health, 10, 28-34.
- Rogers, J. & Hill, D. (1980). Learning style preferences of bachelor's and master's students in occupational therapy. American Journal of Occupational Therapy, 34, 789-793.
- Rule, D. & Grippen, P. (1980). A critical comparison of learning style instruments frequently used with adult learners. Paper presented at the Annual Conference of the Eastern Educational Research Association (Miami Beach, FL, Feb. 24-27, 1988). (ERIC Document Reproduction Service No. ED 261 086)
- Savage, K. and Dorgan, C. A. (Ed.) (1990). Professional Careers Sourcebook. Gale Research, Inc., Detroit, MI.
- Sewall, J. (198). The measurement of learning style: A critique of four assessment tools. Report of Assessment Center, Wisconsin University. (ERIC Document Reproduction Service No. ED 267 247)

- Spatz, C. (1992). Basic statistics: tales of distributions. Brooks/Cole Publishing Co., Belmont, CA.
- Svinicki, M. D., Dixon, N. M. (1988). The Kolb model modified for classroom activities. College Teaching, 35(4), 141 - 146.
- Springer, S. P. & Deutsch, G. (1981) Left brain right brain. San Francisco, CA. W. H. Freeman.
- U. S. Department of Labor Employment and Training Administration (1991). Dictionary of Occupational Titles (Fourth Ed.). JST Works, Inc., Indianapolis, MN.
- Vittetoe, M. (1983). A study of learning style preference of medical technology and physical therapy students. American Journal of Medical Technology, 49, 661-664.
- Vittetoe, M., & Hooker, E. (1983). Learning style preferences of allied health practitioners in a teacher education program. Journal of Allied Health, 12, 48-55.
- Witkin H. A., Moore, C. A., Oltman, P. K., Friedman, F., Owen, D. R. & Raskin, E. (1977). The role of field-dependent and field-independent cognitive styles in academic evolution: A longitudinal study. Journal of Medical Technology, 49, 661-664.

APPENDIX-A
INSTRUCTIONS TO PARTICIPANTS

The inventory that you are about to take is designed to help you determine your preferences for learning and processing information. You will be able to use this information to improve your classroom and study efforts and, hopefully, help you to take advantage of many different learning opportunities. The inventory is called the Learning Style Inventory and was developed by Dr. David Kolb in 1985 and has had widespread use in medical education.

The results this inventory are completely confidential. You do not have to share this information with anyone else, though you may find it interesting to compare your results with your classmates, if you would like to do so.

I am conducting a research project on the learning styles of physical therapist assistant students and would like to include your inventory as part of the data. Students will not be identified by name as part of the project--it will not be possible to identify students' data by name. Your participation is completely voluntary and your decision to participate will not affect your grade in this course.

If you decide to participate, after completing the inventory and the discussion, hand the completed inventory to me. I will copy them and return the originals to you in one or two days.

APPENDIX-B
LEARNING STYLE INVENTORY 1985

Learning-Style Inventory

1. When I learn: I like to deal with my feelings. I like to watch and listen. I like to think about ideas. I like to be doing things.
2. I learn best when: I trust my hunches and feelings. I listen and watch carefully. I rely on logical thinking. I work hard to get things done.
3. When I am learning: I have strong feelings and reactions. I am quiet and reserved. I tend to reason things out. I am responsible about things.
4. I learn by: feeling. watching. thinking. doing.
5. When I learn: I am open to new experiences. I look at all sides of issues. I like to analyze things, break them down into their parts. I like to try things out.
6. When I am learning: I am an intuitive person. I am an observing person. I am a logical person. I am an active person.
7. I learn best from: personal relationships. observation. rational theories. a chance to try out and practice.
8. When I learn: I feel personally involved in things. I take my time before acting. I like ideas and theories. I like to see results from my work.
9. I learn best when: I rely on my feelings. I rely on my observations. I rely on my ideas. I can try things out for myself.
10. When I am learning: I am an accepting person. I am a reserved person. I am a rational person. I am a responsible person.
11. When I learn: I get involved. I like to observe. I evaluate things. I like to be active.
12. I learn best when: I am receptive and open-minded. I am careful. I analyze ideas. I am practical.

TOTAL the scores from each column:

Column 1

Column 2

Column 3

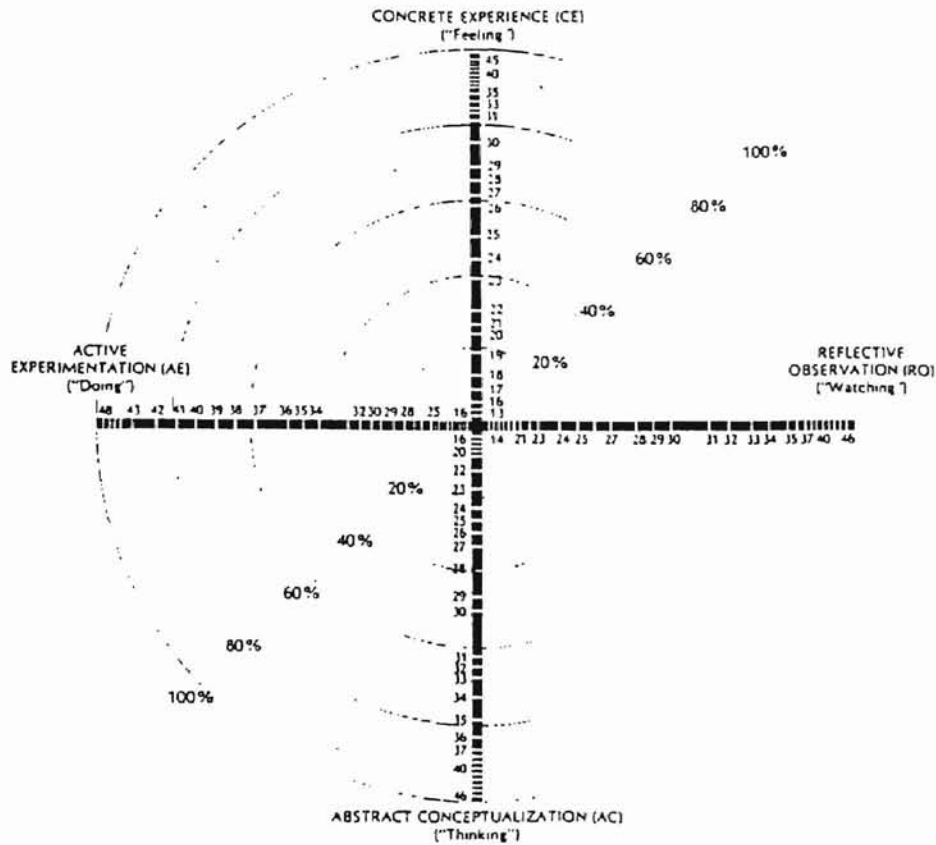
Column 4

The Cycle of Learning

The four columns that you have just totaled relate to the four stages in the Cycle of Learning from Experience. In this cycle are four *learning modes*: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Enter your total scores from each column:

Column 1 (CE): Column 2 (RO): Column 3 (AC): Column 4 (AE):

In the diagram below, put a dot on each of the lines to correspond with your CE, RO, AC, and AE scores. Then connect the dots with a line so that you get a "kite-like" shape. The shape and placement of this kite will show you which learning modes you prefer most and which you prefer least.



The Learning-Style Inventory is a simple test that helps you understand your strengths and weaknesses as a learner. It measures how much you rely on four different learning modes that are part of a four-stage cycle of learning. Different learners start at different places in this cycle. Effective learning uses each stage. You can see by the shape of your profile (above) which of the four learning modes you tend to prefer in a learning situation.¹

On the next page are explanations of the different learning modes.

¹ One way to understand the meaning of your LSI scores better is to compare them with the scores of others. The profile above gives norms on the four basic scales (CE, RO, AC, AE) for 1,446 adults ranging from 18 to 60 years of age. The sample group contained slightly more women than men, with an average of two years beyond high school in formal education. A wide range of occupations and educational backgrounds is represented. The raw scores for each of the four basic scales are listed on the crossed lines of the target. The concentric circles on the target represent percentile scores for the normative group. In comparison to the normative group, the shape of your profile indicates which of the four basic modes you tend to emphasize and which you emphasize less.

The Four Stages of the Learning Cycle and Your Learning Strengths

CONCRETE EXPERIENCE (CE)

This stage of the learning cycle emphasizes personal involvement with people in everyday situations. In this stage, you would tend to rely more on your feelings than on a systematic approach to problems and situations. In a learning situation, you would rely more on your ability to be open-minded and adaptable to change.

REFLECTIVE OBSERVATION (RO)

In this stage of the learning cycle, people understand ideas and situations from different points of view. In a learning situation you would rely on patience, objectivity, and careful judgment but would not necessarily take any action. You would rely on your own thoughts and feelings to form opinions.

ABSTRACT CONCEPTUALIZATION (AC)

In this stage, learning involves using logic and ideas, rather than feelings, to understand problems or situations. Typically, you would rely on systematic planning and develop theories and ideas to solve problems.

ACTIVE EXPERIMENTATION (AE)

Learning in this stage takes an active form — experimenting with influencing or changing situations. You would have a practical approach and a concern with what really works, as opposed to watching a situation. You value getting things done and seeing the results of your influence and ingenuity.

Learning from feeling

- Learning from specific experiences
- Relating to people
- Sensitivity to feelings and people

Learning by watching and listening

- Careful observation before making a judgment
- Viewing things from different perspectives
- Looking for the meaning of things

Learning by thinking

- Logical analysis of ideas
- Systematic planning
- Acting on an intellectual understanding of a situation

Learning by doing

- Ability to get things done
- Risk taking
- Influencing people and events through action

REMEMBER:

1. The LSI gives you a general idea of how you view yourself as a learner.
2. Because learning is a cycle, the four stages occur time after time. Often in a learning experience you may have to go through the cycle several times.
3. The LSI does not measure your learning skills with 100% accuracy. You can find out more about how you learn by gathering information from other sources — your friends, instructors, and co-workers.

Learning Style

From the preceding descriptions of Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation, you may have discovered that no single mode entirely describes your learning style. This is because each person's learning style is a combination of the four basic learning modes. Because of this, we are often pulled in several directions in a learning situation. By combining your scores, you can see which of four learning-style types best describes you. They are named as follows:

- Accommodator
- Diverger
- Converger
- Assimilator

Understanding your learning-style type — its strengths and weaknesses — is a major step toward increasing your learning power and getting the most from your learning experiences.

Learning-Style Type Grid

Take your scores for the four learning modes, AC, CE, AE, and RO, listed on page 4, and subtract as follows to get your two combination scores:

$$\square - \square = \square$$

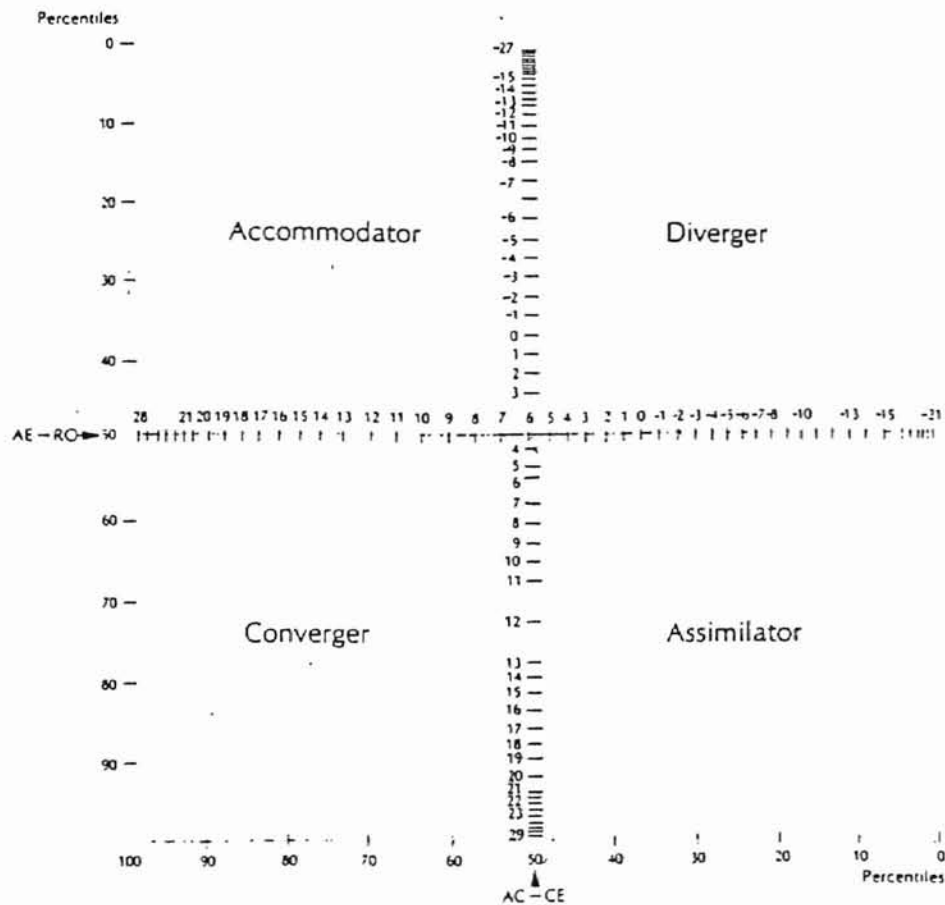
AC CE AC - CE

$$\square - \square = \square$$

AE RO AE - RO

A positive score on the AC - CE scale indicates that your score is more abstract. A negative score on the AC - CE scale indicates that your score is more concrete. Likewise, a positive or negative score on the AE - RO scale indicates that your scores are either more active or more reflective.

By marking your two combination scores, AC - CE and AE - RO, on the two lines of the following grid and plotting their point of interception, or *data point*, you can find which of the four learning styles you fall into. These four quadrants, labeled Accommodator, Diverger, Converger, and Assimilator, represent the four dominant learning styles.



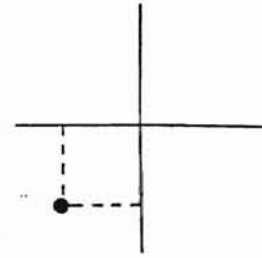
The quadrant of the Learning-Style Type Grid into which your data point falls shows your preferred learning style. For example: If your AC - CE score was -8 and your AE - RO score was +15, your style would fall into the Accommodator quadrant. An AC - CE score of +7 and an AE - RO score of +10 would fall into the Converger quadrant. The closer the data point is to the center of the grid, the more balanced is your learning style. If the data point falls near any of the far corners of the grid, you tend to rely heavily on one particular learning style.

The Four Learning-Style Types²

CONVERGER

Combines learning steps of
ABSTRACT CONCEPTUALIZATION and **ACTIVE EXPERIMENTATION**

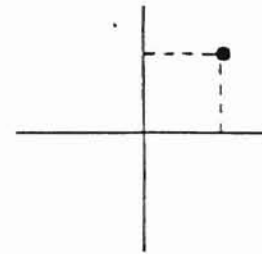
People with this learning style are best at finding practical uses for ideas and theories. If this is your preferred learning style, you have the ability to solve problems and make decisions based on finding solutions to questions or problems. You would rather deal with technical tasks and problems than with social and interpersonal issues. These learning skills are important to be effective in specialist and technology careers.



DIVERGER

Combines learning steps of
CONCRETE EXPERIENCE and **REFLECTIVE OBSERVATION**

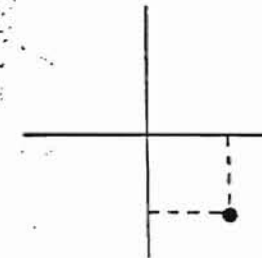
People with this learning style are best at viewing concrete situations from many different points of view. Their approach to situations is to observe rather than take action. If this is your style, you may enjoy situations that call for generating a wide range of ideas, as in a brainstorming session. You probably have broad cultural interests and like to gather information. This imaginative ability and sensitivity to feelings is needed for effectiveness in the arts, entertainment, and service careers.



ASSIMILATOR

Combines learning steps of
ABSTRACT CONCEPTUALIZATION and **REFLECTIVE OBSERVATION**

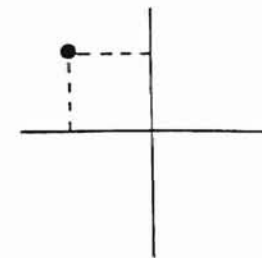
People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. If this is your learning style, you probably are less focused on people and more interested in abstract ideas and concepts. Generally, people with this learning style find it more important that a theory have logical soundness than practical value. This learning style is important for effectiveness in information and science careers.



ACCOMMODATOR

Combines learning steps of
CONCRETE EXPERIENCE and **ACTIVE EXPERIMENTATION**

People with this learning style have the ability to learn primarily from "hands-on" experience. If this is your style, you probably enjoy carrying out plans and involving yourself in new and challenging experiences. Your tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, you may rely more heavily on people for information than on your own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales.



² The Learning-Style Inventory is based on several tested theories of thinking and creativity. This is reflected in its terminology. *Assimilation* and *accommodation* originate in Jean Piaget's definition of intelligence as the balance between the process of adapting concepts to fit the external world (*accommodation*) and the process of fitting observations of the world into existing concepts (*assimilation*). *Convergence* and *divergence* are the two essential creative processes identified by J. P. Guilford's structure-of-intellect model.

The Importance of Understanding Your Learning Style

The ability to learn is the most important skill you can acquire. We are often confronted with new experiences or learning situations in life, in our careers, or on the job. In order to be an effective learner you have to *shift* — from getting involved (CE), to listening (RO), to creating an idea (AC), to making decisions (AE). As an adult, you have probably become better at some of these learning skills than others. You tend to rely on some skills and steps in the learning process more than others. As a result you have developed a learning style.

Understanding your learning style helps you become aware of your strengths in some steps of the learning cycle. One way you can improve your learning effectiveness is to use those strengths when you are called upon to learn. More important, you can increase your effectiveness as a learner by improving your use of the steps you underuse.

Another way of understanding your learning style is to see how closely related it is to:

- choosing careers
- problem solving
- managing people
- working as part of a team

On the following pages, you will:

- see how problem solving relates to learning styles
- learn how to strategize to improve your learning skills
- find out which careers are closely related to certain learning styles

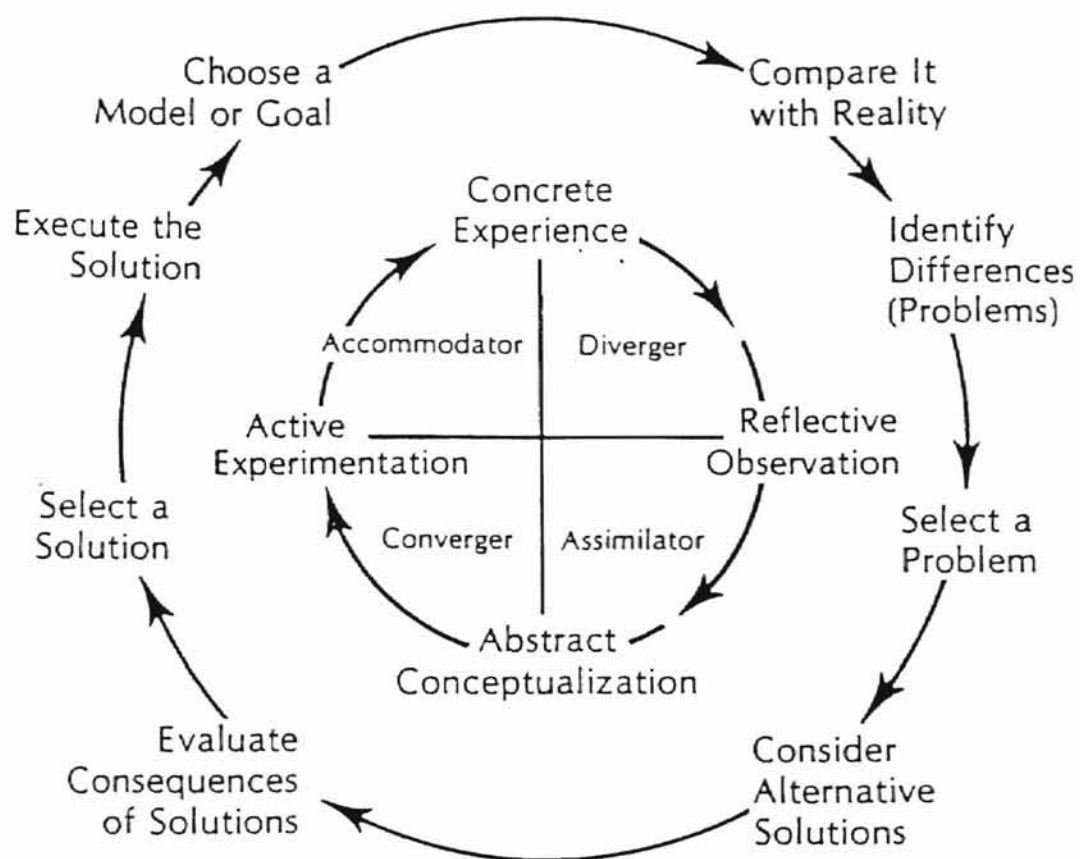
Using the Learning Cycle to Help Solve Problems

Understanding your learning style can make you an effective problem solver. Nearly every problem that you encounter on the job or in your life involves the following skills:

- identifying the problem
- selecting the problem to solve
- seeing different solutions
- evaluating possible results
- implementing the solution

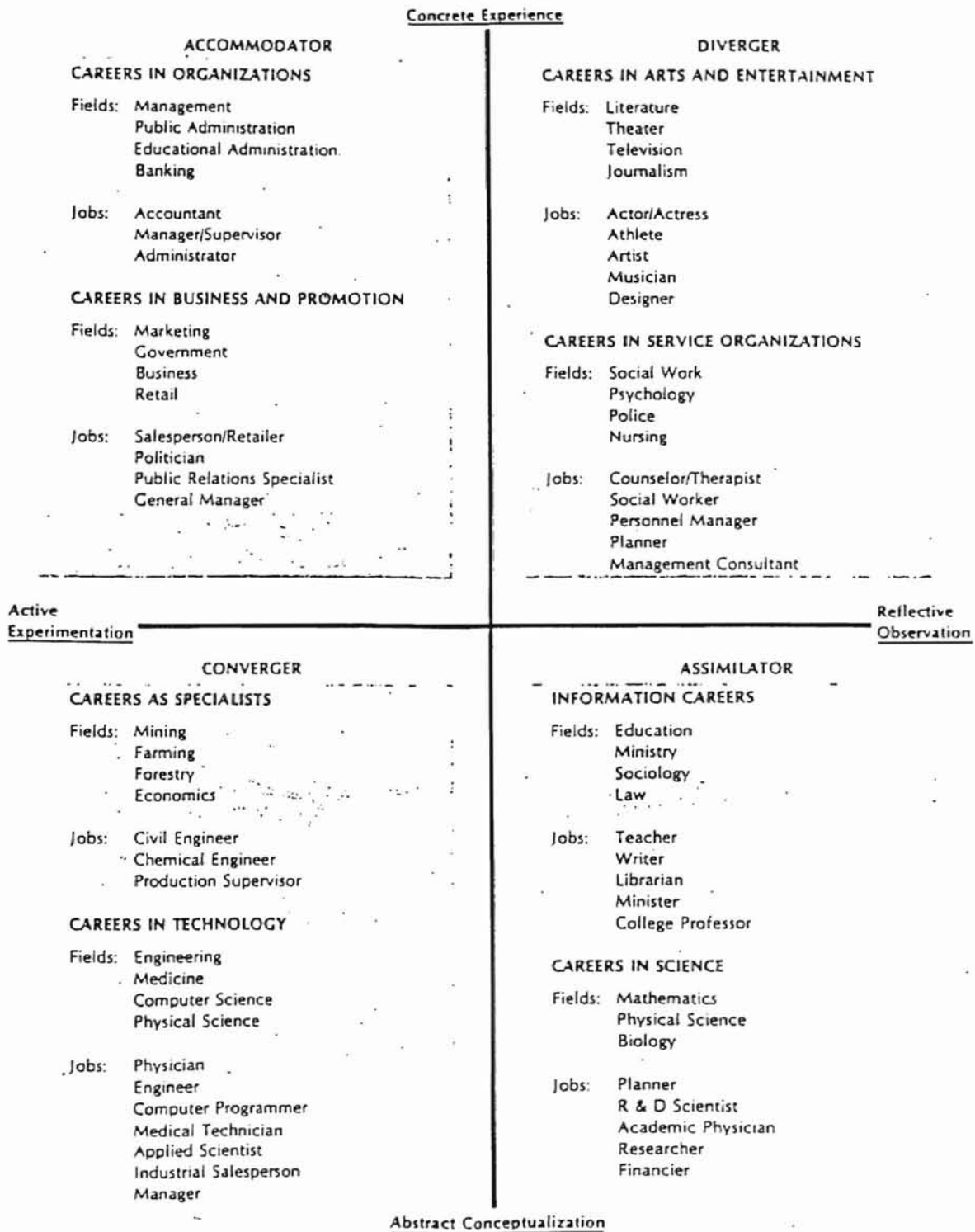
Different pieces of the problem must be approached in different ways. Look back at your strengths and weaknesses in the four learning modes. Compare them with the problem-solving model illustrated below. If you rely heavily on Concrete Experience, you may find that you can easily identify problems that need to be worked on or solved. However, you may need to increase your ability to evaluate possible solutions, as in Abstract Conceptualization. Or you may find that your strong points rest with carrying out or implementing solutions, as in Active Experimentation. If this is so, you may need to work on carefully selecting the problem, as in Reflective Observation.

Comparison of the Learning Cycle with Problem-Solving Skills

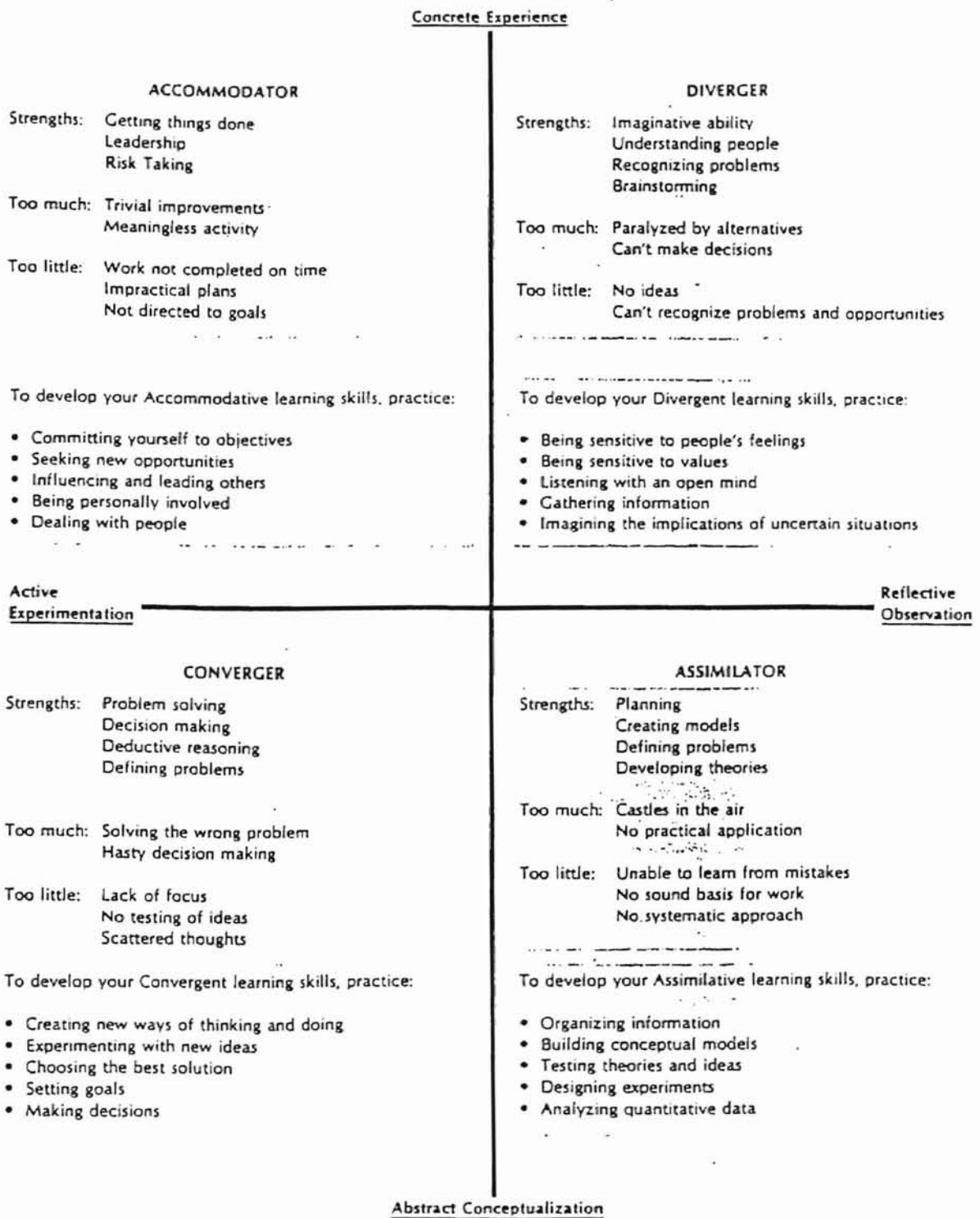


In the next section you will find some strategies to help you develop your learning skills.

Review the Career Map below. See how well your learning style matches your job.



The chart below pinpoints the strengths and weaknesses of each learning style with notes for improvement.



Resources for Further Study

Experiential Learning: Experience as the Source of Learning and Development

by David A. Kolb. Englewood Cliffs, NJ: Prentice-Hall, 1984

The theory of experiential learning, with applications to education, work, and personal development. Contains information on the validity of the Learning-Style Inventory

User Guide for the Learning-Style Inventory

by Donna Smith and David A. Kolb. Boston: McBer and Company, 1985.

A manual for teachers and trainers.

Personal Learning Guide

by Richard Baker, Nancy Dixon, and David A. Kolb. Boston: McBer and Company, 1985.

A practical guide to increasing one's learning from a training program or course of study. Includes the Learning-Style Inventory. Available in training and college editions.

Bibliography of Research on Experiential Learning and the Learning-Style Inventory

Boston: McBer and Company, 1985.

References to recent studies.

APPENDIX-C
INSTITUTIONAL REVIEW BOARD APPROVAL

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 07-19-95

IRB#: ED-96-004

Proposal Title: THE RELATIONSHIP BETWEEN LEARNING STYLE
PREFERENCES OF PHYSICAL THERAPIST ASSISTANT STUDENTS AND
SELECTED DEMOGRAPHICS

Principal Investigator(s): Gary D. Oakley, Kathleen G. Johnson

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved


ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD
AT NEXT MEETING.

APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A
CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD
APPROVAL.

ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR
APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval
are as follows:

Signature:


Chair of Institutional Review Board

Date: July 24, 1995

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VITA

Kathleen G. Johnson

Candidate for the Degree of
Master of Science

Thesis: THE RELATIONSHIP BETWEEN LEARNING STYLE
PREFERENCES OF PHYSICAL THERAPIST ASSISTANT
STUDENTS AND SELECTED DEMOGRAPHICS: IMPLICATIONS
FOR TEACHING

Major Field: Occupational and Adult Education

Biographical:

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Presbyterian Hospital, Dallas, Texas, 1971-75;
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Staff Physical Therapist, Hillcrest Medical
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Tulsa Community College, Physical Therapist
Assistant Program, 1990-92; Academic Coordinator
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Trainer for Clinical Instructors, American
Physical Therapy Association, June, 1997-present.

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